

Chapter 12

Relational Architecture of Economic Systems

Chapter 12 develops the foundational economic architecture required for substantive Generative Relational Economics (GRE). Its role is to specify the principal analytical objects through which economic systems can be studied relationally and historically before later chapters examine allocation, value, generative spacetime, power, epistemic economy, artificial intelligence, and domain-specific applications. The chapter's objective is therefore architectural rather than exhaustive: it establishes a revisable vocabulary for economic subjects, entities, events, relations, properties, states, processes, institutions, resources, capacities, access conditions, ownership, transfer, participation, dependence, asymmetry, symbolic representation, topology, history, and generative potential. The discussion proceeds by progressively widening the analytical resolution while repeatedly returning to the same methodological discipline: an economic object should be specified through the relations, histories, mechanisms, scales, and evidential conditions that make it relevant to the inquiry. The method is conceptual, historical, relational, and selectively formal. Mathematical or field-like representations are used only where they add analytical content, and the chapter maintains ontological suspension throughout.

Throughout this chapter, the phrase *economic systems* is used in a broad and scale-relative sense. It does not refer only to national economies, market economies, or regime types such as capitalism or socialism. It denotes a historically situated economic configuration that is treated as a system because selected economic entities, relations, events, properties, states, processes, structures, constraints, and differences are sufficiently coupled for their joint organization to matter to the inquiry. Such a system can be reconstructed at household, organizational, institutional, market, infrastructural, regional, national, transnational, or cross-scale levels. The word *system* therefore indicates organized interdependence rather than closure, equilibrium, self-sufficiency, or commitment to one mathematical systems representation. Its boundary remains an empirical and analytical attribution that can be revised when another delineation better captures the relevant mechanisms and histories.

The chapter begins from the proposition that the economic domain is neither a timeless substance nor a residual category defined only after politics, law, culture, ecology, and technology have been separated away. Economic specificity is treated

as historically and problem-relatively constructed. Scarcity, allocation, production, ownership, exchange, care, knowledge, finance, infrastructure, institutional access, and livelihood can each become economically salient under different questions. The task is not to settle a universal boundary around “the economy” but to state why a relation, entity, resource, institution, or process enters the economic frame and what mechanism makes that specification useful.

This approach requires a distinction between economic reality and its manifestations. Prices, accounts, contracts, classifications, legal titles, employment statuses, organizational charts, and statistical indicators can be causally consequential and can partly constitute economic positions, yet they do not necessarily exhaust the relational configurations that sustain those positions. Conversely, economically significant relations can precede or exceed their formal recognition. The chapter therefore separates relational reality, manifest representation, and institutional recognition while allowing them to interact recursively.

The chapter’s internal organization is anchored in the domain-general GR ontology developed earlier in the book. Section 12.3 makes that architecture explicit by relating the preliminary coordinates of constraint, change, structure, and difference to the emergent object forms of entity, event, relation, property, state, and process. The correspondence is many-to-many: later economic concepts such as markets, organizations, labor, ownership, or allocation can combine several ontological forms, while one ontological form can be instantiated through many economic objects. The map is used to orient the chapter and identify conceptual gaps rather than to impose a closed classification on economic reality.

Economic subjects and entities are treated as heterogeneous analytical objects. Persons, households, organizations, communities, public authorities, artificial systems, and non-human participants can occupy economically consequential positions, but comparability along one dimension does not imply equivalence along others. Subjecthood, agency, responsibility, welfare, recognition, participation, and historical continuity remain distinct questions. Economic entities are likewise represented as stabilized configurations whose boundaries, persistence, and identity can vary across legal, organizational, accounting, technical, functional, and relational dimensions. Stabilization means sufficient trackability for a stated purpose, not immobility or metaphysical permanence.

Relations constitute the central connective vocabulary of the chapter. Exchange, production, labor, ownership, credit, care, knowledge, trust, authority, dependence, cooperation, and conflict are treated as heterogeneous relation-forms that can overlap within the same empirical connection. Higher-order relations become relevant where configurations of several relations or participants contribute explanatory content that would be lost under adequate pairwise decomposition. Relational configurations then provide an intermediate analytical level between individual ties and larger structures such as organizations, institutions, markets, communities, platforms, and infrastructures.

Boundaries and membership are treated as economically consequential rather than merely classificatory. Legal, organizational, institutional, market, community, functional, access, exposure, and permeability boundaries can diverge. Formal membership can differ from effective participation, access, entitlement, obligation,

representation, control, exposure, or practical ability to exit. Internal and external relations are therefore boundary-relative: the same relation can be internal to one configuration and external to another without contradiction. This boundary discipline becomes especially important when analyzing organizations, institutions, markets, households, commons, platforms, and infrastructures, whose practical edges frequently differ from their formal ones.

Organizations are represented as relational condensations: comparatively stabilized concentrations of membership, roles, authority, coordination routines, resources, memory, and external interfaces that make selected collective capacities reproducible through time. Institutions are represented as relational infrastructures spanning formal and informal rules, norms, classifications, expectations, legal structures, administrative procedures, memory, and enforcement. Markets are treated as relational fields in which exchange and price coordination interact with participation conditions, information, expectations, cooperation, competition, intermediation, and historically constructed boundaries. Households, communities, and commons are analyzed without collapsing them into a single non-market category, while platforms and infrastructures are distinguished according to their mediating, access-organizing, standard-setting, and dependency-generating roles.

The chapter then develops the economic conditions through which action becomes possible. Resources are treated as relation-dependent and capacity-relative rather than as self-identifying stocks. Material, financial, temporal, spatial, informational, knowledge, attentional, infrastructural, institutional-access, and relational resources can differ in accessibility, durability, convertibility, and dependence on complementary conditions. Capacities concern what subjects or configurations can effectively do under specified conditions; constraints concern the conditions that restrict, shape, or channel those capacities. Resources, capacities, and constraints therefore remain analytically distinct, and they can co-evolve through action and institutional change.

Economic access adds another layer. Availability, formal eligibility, practical usability, continuity, timing, cost, mediation, and influence can diverge. Ownership and control are similarly decomposed into legal title, possession, use, exclusion, transfer, shared claims, rule-setting, and effective control. Transfer and circulation then describe changes in claims, possession, use, obligations, information, value, and control positions across time without assuming a conserved scalar moving unchanged through the system. Labor and participation broaden the account of economic contribution beyond formal employment, including paid and unpaid work, care, knowledge-intensive activity, automated participation, representation, exposure, and contribution outside employment relations.

Coordination and dependence describe how differentiated activities become mutually compatible and how capacities rely on resources, actions, knowledge, infrastructures, or permissions located elsewhere. Hierarchical, market, network, cooperative, and algorithmic coordination can each coexist with mutual or asymmetric dependence. Economic asymmetry is subsequently treated as dimension-specific difference in resources, capabilities, information, epistemic position, relational position, institutional standing, temporal position, or related conditions. Asymmetry can convert across dimensions and persist through identifiable mechanisms, yet asymmetry alone does not establish a normative verdict or a complete theory of power.

Economic life is also symbolized. Legal categories, administrative classifications, accounting systems, statistics, contracts, prices, credit representations, ratings, scores, and digital records make relations visible, comparable, actionable, and sometimes self-transforming. Representations can contain observational, categorical, temporal, scale, or functional mismatch; they can also become performative when identifiable uptake mechanisms connect them to subsequent changes in expectations, access, classification, or action. Economic representation is therefore treated both as an epistemic interface and, under some conditions, as part of the economic architecture itself.

Topology, scale, and history provide additional representational dimensions. Network connectivity, centrality, clustering, bridging, bottlenecks, peripheral positions, and field-like variation can illuminate patterned connection where those representations add explanatory content. Their use does not imply that economic reality is ultimately a network or field. Scale is treated as problem-relative rather than as a fixed micro–meso–macro ontology, and cross-scale claims require explicit mechanisms of transmission, aggregation, mediation, or feedback. Historical architecture develops through formation, stabilization, reproduction, crisis, reorganization, dissolution, path dependence, and emergence; continuity and change can coexist along different dimensions.

These architectural elements culminate in the concept of generative potential. An economic architecture can make later relations, capabilities, knowledge states, participation forms, options, constraints, dependencies, and transitions more or less accessible without determining which future will be realized. Generative potential is neither a scalar synonym for welfare nor a probability by default. It can be differentiated across positions, self-reinforcing, fragile, and historically reweighted. Greater generative potential is not automatically normatively preferable because economic architectures can generate exclusion, dependency, vulnerability, concentration, or foreclosure alongside knowledge, capability, cooperation, and expanded options.

The final architectural problem concerns allocation. Allocation changes more than recipient holdings when it modifies conversion conditions, relations, higher-order structures, asymmetries, scales, and later possibilities. The chapter therefore closes by representing allocation as a situated intervention within economic architecture while keeping recipient-centered models available where their omitted relational dimensions are immaterial to the stated purpose. This preserves a general GRE commitment that recurs throughout the chapter: analytical complexity should be added when it changes explanation, interpretation, or practical judgment, not merely because a richer vocabulary is available.

The architecture developed here is intentionally open. The chapter does not claim to enumerate every economically relevant subject, relation, resource, institution, or generative mechanism. New technologies, ecological conditions, legal forms, social practices, and forms of agency may require additional concepts or revisions to those developed here. Nor does the chapter assign universal normative priority to persistence, generativity, decentralization, participation, access, symmetry, sustainability, or any other recurring consideration. These properties become objects of evaluation only after their subjects, histories, consequences, scales, and normative commitments have been specified.

This open status also constrains formalization. Networks, fields, event complexes, dynamical models, operator representations, optimization problems, simulations, and statistical models can provide consistent and operational languages for selected economic questions. Their usefulness depends on the adequacy of their objects, assumptions, evidence, and scope. Historical, interpretive, naturalistic, participatory, and institutional approaches can disclose dimensions that formal models compress or leave implicit, while those approaches have their own limits of operationalization, verification, transportability, or comparability. GRE therefore treats methodological composition as problem-relative and revisable rather than prescribing one universal representational language.

Taken together, the chapter provides an economic object architecture rather than a closed economic ontology. Its purpose is to make visible the relations through which economic entities acquire practical meaning, the conditions through which resources become capacities, the structures through which access and control are organized, the histories through which configurations persist or transform, and the generative consequences through which present arrangements condition later possibilities. This architecture supplies the descriptive and analytical substrate on which later GRE work can formulate more specific theories of allocation, value, economic spacetime, power, knowledge, artificial intelligence, and economic organization without assuming that any one of those domains exhausts the economic world.

12.1 Economic Specificity and Domain Boundaries

The role of this section is to open Part V by moving from the domain-general foundations of Generative Relational Theory (GR) back into the substantive economic programme of Generative Relational Economics (GRE). Its objective is to specify what it means for a relational-generative inquiry to become economic without assuming that the economic domain has a timeless, self-evident boundary or that general GR concepts acquire economic meaning automatically. The discussion proceeds through seven steps: GRE as an economic specification of GR praxis, the historical and problem-relative character of economic specificity, the selection of economic objects, the interpretation of economic relations and configurations, the role of constraints and capacities, the scope conditions governing cross-domain translation, and the standing of GRE as a domain instantiation of a broader research programme. The method is reconstructive and programmatic. It draws on the disciplinary constitution established in Chapter 3, the domain-general epistemology and methodologies of Parts II–IV, and several established traditions that delimit economics in different ways, while treating the substantive architecture developed in this chapter as provisional and revisable.

The transition requires some care because the word *economic* already carries several intellectual histories. Scarcity and alternative uses have provided one influential delimitation of economic inquiry (Robbins 1932). Historical and institutional traditions have emphasized the changing organization of livelihood, exchange, property, and markets (Polanyi 1944; North 1990; Ostrom 1990). Relational sociology has shown that economic action can depend materially on ongoing social relations rather than on atomized actors alone (Granovetter 1985). Work on ethics and economics has ques-

Table 12.1: Illustrative dimensions for specifying an economic field in GRE. The dimensions identify recurrent questions while leaving their substantive answers open to historical and empirical inquiry.

Dimension	Specification question	Scope discipline
Practical relevance	Which production, allocation, access, exchange, provisioning, labor, ownership, care, finance, or related processes make the field economically consequential?	Economic relevance is stated for the inquiry at hand rather than presumed from a fixed list of activities.
Subjects and positions	Which persons, households, organizations, communities, authorities, artificial systems, or other participants occupy economically consequential positions?	Economic positions do not exhaust the histories or identities of the participants that occupy them.
Relations	Which relations organize capacities, obligations, resources, expectations, dependencies, coordination, or transfers?	A relation can simultaneously have legal, political, cultural, ecological, or technological significance.
Resources and capacities	Which material, financial, informational, institutional, ecological, technical, social, or symbolic conditions affect what participants can do?	Resource status and economic salience depend on the relational and historical configuration.
Institutions and representations	Which rules, organizations, prices, accounts, classifications, contracts, metrics, or models stabilize and mediate economic interaction?	Representation can describe a field and can also participate in changing it.
History and scale	Which event histories, temporal horizons, scales, path dependencies, and transition processes affect the economic configuration?	Economic conclusions are qualified by the historical and scalar range over which they are supported.
Normative and disciplinary interfaces	Which value conflicts, responsibilities, power relations, legal rules, political authorities, ecological conditions, or cultural meanings materially affect the economic problem?	GRE preserves interfaces with neighboring domains rather than converting their distinctive questions into economics by default.

tioned attempts to isolate economic evaluation from broader questions of agency, welfare, and value (Sen 1987). Historical analysis has also shown that the modern “economy” itself became stabilized as a particular object of representation and governance rather than simply appearing as an unchanged object across periods (Mitchell 1998). GRE enters this plural field as a further research programme, not as a replacement definition capable of settling the disciplinary boundary once and for all.

Table 12.1 summarizes the dimensions through which the present chapter begins to specify an economic field. The table is a guide to inquiry rather than a checklist. Different empirical problems can require different resolutions, and some dimensions may remain outside the foreground of a particular study.

12.1.1 GRE as an Economic Specification of GR Praxis

Parts II–IV constructed a domain-general account of relational reality, epistemic access, research praxis, and application-dominant praxis. Those foundations provide GRE with a language for studying historical-relational subjects, epistemic events, partially ordered histories, changing constraints, performative representations, decision under incomplete knowledge, and interventions that alter later possibilities. Economic analysis begins when those general resources are specified through economically consequential objects and relations.

The term *specification* is important. It does not mean that a general GR model is first completed and then mechanically populated with economic variables. Economic inquiry can modify the meaning, resolution, and usefulness of the general categories themselves. A relation relevant to contract enforcement may need a different representation from a relation relevant to household care. A historical-relational subject represented adequately for a labor-market question may require additional institutional, familial, migratory, legal, or technical history for another economic problem. An intervention architecture suitable for a reversible pricing experiment can be inadequate for an infrastructural investment with long-lived dependencies. Economic specificity therefore emerges through reciprocal adjustment between the general framework and the domain being studied.

Chapter 3 already established GRE as an emerging economic research programme and distinguished it from broader GR. The present section does not reopen that disciplinary constitution. It gives the distinction substantive force. GRE assumes responsibility for economic explanation, evidence, mechanism, and interpretation. General GR supplies transferable questions and representations, while the economic domain determines whether those resources are adequate to production, allocation, circulation, provisioning, exchange, capability, ownership, labor, value, dependence, institutional organization, and the transformation of future economic possibility.

This relation is asymmetric in neither direction. General GR does not function as a doctrinal authority whose concepts economic cases are expected to confirm. Economic inquiry can reveal that a general distinction is too coarse, that a proposed representation omits an economically consequential mechanism, or that a category behaves differently once embedded in institutions such as property, credit, taxation, labor organization, accounting, or market exchange. Such findings can remain local to GRE, or they can later motivate revision of the wider GR programme. Domain instantiation is therefore also a potential source of theoretical correction.

A GRE study consequently need not deploy every concept introduced in the preceding Parts. The relevant methodological and conceptual resources depend on the research problem. Some inquiries may be adequately handled through institutional history and comparative evidence. Others may benefit from network, dynamical, statistical, computational, or field representations. Some may require participatory or interpretive access because economically consequential relations are mediated through meanings, classifications, expectations, or tacit practices. The economic programme inherits methodological pluralism together with the obligation to justify the local adequacy of the selected methods.

12.1.2 Historical and Problem-Relative Economic Specificity

Economic specificity concerns the conditions under which a phenomenon is treated as economically relevant for a particular inquiry. The present framework does not seek a single necessary-and-sufficient definition that would permanently separate economic from non-economic reality. The history of economic thought already provides several influential delimitations, and empirical economic life repeatedly crosses the conceptual boundaries associated with any one of them. Scarcity, market exchange, production, livelihood, institutions, welfare, ownership, labor, finance, household provisioning, public goods, care, knowledge, infrastructure, and ecological dependence can each become central under different theoretical and historical conditions.

The diversity matters because a boundary of inquiry changes what becomes visible. A scarcity-centered analysis can clarify trade-offs among means with alternative uses (Robbins 1932). An institutional analysis can reveal how rules and enforcement structures organize incentives and uncertainty (North 1990). Analysis of commons can disclose governance arrangements that are difficult to understand through a simple market-state contrast (Ostrom 1990). Embeddedness analysis can show how supposedly economic transactions depend on relational structures (Granovetter 1985). Ethical and capability-oriented analysis can expose evaluative information that disappears when welfare is compressed into one behavioral or monetary representation (Sen 1987). These approaches need not be made equivalent for GRE to learn from the different aspects of economic specificity they disclose.

GRE therefore adopts a problem-relative boundary with explicit historical and disciplinary qualifications. A phenomenon becomes economically salient within an inquiry when its relations, constraints, capacities, transfers, institutions, or consequences materially enter the production, allocation, access, use, circulation, maintenance, conversion, or foreclosure of resources and possibilities that the inquiry has reason to treat as economic. The formulation is intentionally broad and remains a working orientation rather than a final definition. Its adequacy depends on whether it helps identify the mechanisms and consequences relevant to the problem without absorbing neighboring domains whose own concepts are doing indispensable explanatory work.

The boundary can change during inquiry. A project initially framed as a labor-market study may discover that immigration status, caregiving obligations, platform governance, housing access, or educational credentialing materially determines the observed employment relation. An analysis of credit may require the legal architecture of collateral and insolvency. A study of infrastructure may require ecological processes that constrain maintenance and future use. A study of automated allocation may encounter classifications whose political or legal authority determines economic access. Such discoveries can justify enlarging the economic specification, establishing an interdisciplinary interface, or returning part of the problem to another domain.

This openness does not imply that every social relation is economic. Unlimited scope would deprive the economic designation of analytical function and would obscure the expertise required by other domains. GRE therefore treats boundary choice

as accountable. A study should be able to explain why a relation enters the economic analysis, which consequences make it relevant, what remains outside the economic frame, and where claims require support from law, political science, sociology, history, ecology, engineering, education, ethics, or another field.

Economic specificity is also historically revisable. The categories through which economies are represented can become more or less salient as material technologies, institutions, forms of property, infrastructures, productive forces, and systems of measurement change. Mitchell's historical account of the modern economy as an object of representation is especially relevant here because it cautions against assuming that contemporary macroeconomic boundaries simply reproduce a timeless economic object (Mitchell 1998). GRE extends this caution to its own vocabulary. Categories that currently organize analysis may require revision if new economic relations, agents, infrastructures, or forms of value become consequential.

12.1.3 Economic Objects and Analytical Selection

The substantive economic programme requires objects of analysis, but object selection does not by itself settle their ontological standing. Within GRE, an economic object can be a person occupying an economic position, a household, firm, public authority, community, asset, account, contract, organization, market, infrastructure, classification, resource, platform, currency, or another configuration that is sufficiently stabilized for the local inquiry. Later sections examine how such entities can emerge, persist, transform, and dissolve. The present subsection establishes only the discipline governing their selection.

An economic object is selected at a resolution. A worker can be represented as a labor supplier in one model, as a historically situated subject with skills, obligations, bargaining relations, migration history, and household dependencies in another, or as part of a collective organizational configuration in a third. Each representation can be useful. The question is whether the abstraction preserves the relations required by the claim being made. A representation adequate to estimate a wage response can be inadequate to explain why workers have unequal capacity to refuse the same contract.

Objects also depend on institutional recognition. Property, debt, employment status, organizational membership, account ownership, professional qualification, legal personhood, and eligibility for benefits are not merely descriptive labels attached to pre-given economic entities. Institutional recognition can stabilize positions, authorize actions, create obligations, and change access to resources. Economic analysis must therefore distinguish the physical or social configuration being studied from the institutional and representational processes through which that configuration becomes legible and actionable.

The same caution applies to aggregates. "The household," "the firm," "the market," or "the state" can be analytically useful units while containing internal relations that materially affect the phenomenon under study. Aggregation can hide unequal control, differentiated responsibilities, internal transfers, unrecognized labor, or conflicting interests. Chapter 12 later develops internal and external relations precisely because the adequacy of an aggregate depends partly on what happens inside its ap-

parent boundary.

Analytical selection also concerns absence. Some economically consequential objects remain weakly represented in formal records: informal work, unpaid care, ecological conditions, tacit knowledge, community-maintained infrastructures, or unregistered forms of mutual support can be central to actual provisioning while appearing marginal in official accounts. GRE does not infer importance from measurement alone. Observability is one epistemic property of an object, and institutional visibility can itself be an object of explanation.

Remark 12.1 (Object selection as a revisable commitment). Within the present framework, selecting an economic object commits an inquiry to a particular analytical resolution. The commitment remains revisable when omitted internal structure, external relation, historical trajectory, or institutional recognition materially changes the explanatory or practical question.

Remark 12.1 connects substantive economic architecture to the epistemic discipline developed in Part III. Reconstructing an object is already a methodological decision. Chapter 12 therefore treats objects and relations together rather than assuming that relations merely connect entities whose identity has already been settled.

12.1.4 Economic Relations and Relational Configurations

Relations provide the central analytical orientation of Chapter 12. Economic life is organized through exchanges, production arrangements, labor relations, property claims, credit, care, knowledge, trust, authority, dependency, cooperation, conflict, transfers, memberships, and forms of coordination that can persist beyond any one transaction. These relations can be dyadic, collective, institutional, multilateral, nested, or mediated through infrastructures and representations. Their economic significance depends on what they enable, constrain, transfer, stabilize, or transform within the selected field.

A relational orientation does not imply that entities lack practical reality. Firms sign contracts, households hold assets, banks extend credit, public authorities levy taxes, and individuals make decisions. GRE asks additionally how these actors acquire and reproduce the capacities through which those actions become possible, how their positions depend on relations to others, and how the actions modify the relational field that later actors inherit. The analytical gain comes from holding entity-level and relation-level descriptions together rather than replacing one with the other.

Granovetter's account of embedded economic action provides one established demonstration that ongoing social relations can be economically consequential and that atomized descriptions can omit mechanisms relevant to actual transactions (Granovetter 1985). GRE takes a broader generative question: which later capacities, dependencies, institutions, expectations, and pathways are produced or foreclosed through the relation? The extension is a programmatic proposal rather than an attribution to embeddedness theory itself.

Relations can also change category as institutions and histories evolve. A cooperative exchange can become a dependency when alternatives disappear. Credit can

provide productive capacity and later become a mechanism of constraint. A platform can coordinate previously fragmented participants and simultaneously reorganize access to customers, data, reputation, and payment. Care can sustain labor capacity while remaining weakly represented in market accounts. Ownership can authorize investment while also structuring exclusion. The relational category is therefore insufficient by itself; analysis must reconstruct the configuration, the distribution of positions within it, and the historical processes through which its consequences develop.

Higher-order relations are especially important. A transaction can depend on a banking system, payment infrastructure, legal regime, professional standard, information network, public guarantee, or social convention that is not reducible to the two apparent counterparties. Organizations can coordinate relations internally while mediating them externally. Markets can stabilize recurring expectations and rules among many participants. Commons can organize collective access and responsibility through institutional arrangements that differ from both individualized ownership and centralized administration (Ostrom 1990). Later sections develop these configurations in detail.

The economic relation also provides one bridge to value. A relation can transmit or convert resources and capacities, create or destroy options, change bargaining positions, generate knowledge, reorganize recognition, or alter later productive possibility. Chapter 14 will examine heterogeneous value and value transmission directly. Chapter 12 prepares that analysis by identifying the relational architecture through which such transformations occur.

12.1.5 Economic Constraints, Capacities, and Institutional Conditions

Economic architecture is shaped by both constraints and capacities. A constraint limits feasible action under specified conditions; a capacity supports the ability of a subject or configuration to act, produce, coordinate, learn, convert resources, maintain relations, or enter future possibilities. The same institutional arrangement can function differently across positions. Credit requirements can discipline lending while excluding actors without recognized collateral. Property rules can stabilize investment while restricting access. Technical standards can enable interoperability while raising entry costs. Infrastructure can enlarge mobility for some participants while creating new dependencies for others.

The distinction is relational because neither capacity nor constraint can always be located inside one actor. A worker's bargaining capacity depends partly on alternatives, collective organization, legal protections, household obligations, labor demand, information, and mobility. A firm's productive capacity can depend on suppliers, credit, infrastructure, public institutions, standards, knowledge, and workforce organization. A community's capacity to govern a shared resource can depend on institutional arrangements and histories of cooperation that are invisible if resources are represented only as physical stocks (Ostrom 1990). Economic possibility is consequently distributed across configurations.

Institutional economics provides established resources for analyzing how rules and organizations structure incentives, uncertainty, and economic performance

(North 1990). GRE draws from this concern while keeping a wider field of possible consequences in view. Institutions can structure incentives, but they can also constitute categories, authorize positions, define ownership, create channels of recognition, establish evidentiary standards, allocate decision rights, and shape which future transformations remain available. These effects need not be captured adequately by incentive language alone in every case.

Constraints can be material, institutional, legal, technical, informational, ecological, temporal, organizational, financial, or symbolic. Their analytical standing depends on mechanism. A legal rule is not transformed into an economic law merely because it has economic consequences. An ecological threshold remains an ecological process even when production depends on it. A cultural meaning can affect demand or labor participation without becoming exhausted by its economic effect. GRE can model the economic pathway while preserving the causal and disciplinary identity of the contributing process where that identity matters.

Capacities are similarly heterogeneous. Financial wealth, physical infrastructure, knowledge, health, institutional recognition, social cooperation, technological access, time, legal status, organizational authority, and trusted relationships can each condition economic action. Sen's work on ethics and economics is relevant to this broader caution because it resists identifying economic assessment with a single narrow metric and keeps questions of agency and human advantage visible (Sen 1987). GRE later develops its own account of generative capacity and heterogeneous value; the present point is narrower: a substantive economic architecture should avoid assuming in advance that economically consequential capacities are reducible to one resource form.

Constraints and capacities can co-evolve. An institution created to solve one coordination problem can generate later entry barriers. A technology that expands productive capability can make access to complementary infrastructure more consequential. A public guarantee can stabilize a market while changing expectations about future intervention. A new measurement system can make previously invisible activity governable while also narrowing attention to what the measure captures. These dynamics prepare the later GRE question of generative potential: economic architecture matters partly because it changes the conditions under which future economic architecture can be produced.

12.1.6 Cross-Domain Translation and Scope Conditions

GRE necessarily crosses disciplinary interfaces because economic relations are entangled with legal rules, political authority, social organization, technology, ecology, education, culture, health, and knowledge. Cross-domain translation can enrich economic analysis when it preserves the mechanisms and evidentiary burdens of the contributing domains. It becomes less reliable when a concept is transferred only by analogy or when economic vocabulary absorbs distinctions that remain indispensable elsewhere.

Three scope conditions are especially important in this chapter. First, similarity of relational form does not establish sameness of mechanism. Dependency in a credit relation, dependency in care, dependency in international security, and dependency in an ecological system can share structural features while differing in causal processes,

normative stakes, evidence, and possible interventions. A general GR vocabulary can support comparison, but substantive GRE must justify the economic interpretation locally.

Second, economic consequence does not establish economic exhaustiveness. Law can constitute property and contractual obligation; politics can determine authority and collective decision; education can shape knowledge and credentialing; ecology can determine material reproduction; culture can organize meaning and recognition. Their economic effects can be central to GRE while their broader significance remains outside the economic account. Interdisciplinary adequacy sometimes requires parallel explanations rather than translation into a single common language.

Third, transfer across historical and institutional settings requires evidence. A mechanism observed under one property regime, technological infrastructure, household structure, labor institution, or monetary system may not transport unchanged to another. The problem is analogous to the historical transportability issues discussed in Chapter 11, but its substantive economic form can be sharper because institutions often constitute the relevant objects and relations themselves. Comparative analysis should therefore distinguish a recurrent relational pattern from a claim that the same economic mechanism operates across contexts.

These scope conditions also apply to formal analogies. Network, field, dynamical, geometric, information-theoretic, operator-algebraic, or spacetime representations can reveal structure when their variables and relations are defined with economic meaning. Their mathematical coherence alone does not establish that the economic system instantiates the physical ontology from which the formalism may have been inspired. Ontological suspension remains in force. Formal resources are evaluated through explanatory usefulness, empirical contact, interpretability, and the discipline of their assumptions.

Caution 12.2 (Translation across domains). A concept transferred into GRE should retain a traceable account of its source meaning, the economic mechanism it is being used to represent, the evidence supporting the translation, and the respects in which the source and target domains remain different. Structural resemblance can motivate inquiry; it does not by itself establish theoretical identity.

Caution 12.2 preserves the open relation between GRE and neighboring GR domains. Legal, political, educational, ecological, historical, aesthetic, and technological analyses can correct GRE when the economic account omits mechanisms that are constitutive of the phenomenon. GRE can reciprocally contribute findings about allocation, value conversion, dependency, institutional organization, or generative foreclosure without claiming disciplinary priority over those neighboring domains.

12.1.7 GRE as a Domain Instantiation of GR

GRE can now be stated more precisely as a domain instantiation of GR. The phrase identifies an interface, not a hierarchy. GR provides a broader research space for relation, generation, historical transformation, epistemic mediation, praxis, and emergent normativity across domains. GRE develops economic questions within that space and assumes responsibility for making its objects, mechanisms, evidence, and evaluative commitments economically intelligible.

A domain instantiation has at least four consequences. The first is selective inheritance. GRE uses only those GR concepts that contribute to the economic problem at hand, and it can simplify, modify, or leave aside other resources. The second is substantive reconstruction. Economic subjects, entities, relations, institutions, resources, capacities, and fields require their own empirical and historical specification rather than receiving complete definitions from general theory. The third is reciprocal revision. Economic findings can expose limitations in GR and can motivate new general concepts, while developments in other GR domains can challenge assumptions embedded in GRE. The fourth is boundary accountability. GRE should be able to state why a problem is being treated economically and where its claims depend on neighboring disciplines.

This standing also qualifies the term *relational architecture*. Chapter 12 does not propose that one universal architecture underlies every economy. It develops a vocabulary for reconstructing how economically consequential subjects, entities, relations, boundaries, organizations, institutions, markets, households, commons, platforms, infrastructures, resources, capacities, ownership structures, transfers, labor relations, dependencies, symbolic representations, and multiscale histories are configured in particular settings. Some categories will be central in one setting and marginal in another. New categories can become necessary as economies change.

The architecture is generative because its significance extends beyond a snapshot of current organization. Economic configurations can reproduce or transform the capacities, constraints, relations, institutions, and possibilities from which later economic configurations emerge. This temporal orientation does not make generativity a synonym for improvement. An architecture can generate productive capability, cooperation, knowledge, or new options; it can also generate dependence, exclusion, concentration, ecological degradation, vulnerability, or foreclosure. Evaluation therefore remains separate from the descriptive fact that a configuration has downstream generative effects.

The chapter develops the substantive components of that architecture progressively. Section 312 examines the standing of economic reality under the generative-relational view. Section 313 then makes explicit the GR ontological coordinates through which the later economic object architecture is organized. Sections 314–320 develop subjects, entities, relations, higher-order relations, configurations, boundaries, and internal–external coupling. Later sections examine organizations, institutions, markets, households, commons, platforms, infrastructures, resources, capacities, access, ownership, transfer, labor, coordination, dependence, asymmetry, symbolic relations, topology, fields, multiscale history, and generative potential. The progression moves from economic specificity and ontological coordination toward increasingly composite economic architectures and the conditions through which their later possibilities are produced.

The return to economics therefore marks a change of analytical responsibility. General GR supplied a provisional language for asking how relations, histories, representations, knowledge, and interventions are organized. GRE must now show, case by case and model by model, how those abstractions become economically meaningful. The task begins with economic reality itself: how economic entities and relations acquire sufficient stabilization, manifestation, recognition, and causal

efficacy to function as objects of substantive economic inquiry while remaining historically revisable. Section 312 takes up that problem.

12.2 Economic Reality under the Generative Relational View

The role of this section is to specify the ontological standing of the economic objects that Chapter 12 will subsequently analyze. Its objective is to explain how prices, property positions, organizations, obligations, monetary relations, labor roles, institutional categories, expectations, resource access, and other economically consequential formations can be treated as real for economic inquiry while remaining historically generated, relationally sustained, only partially manifested, and open to revision. The discussion proceeds through relational emergence, stabilization, persistence, causal efficacy, manifestation, institutional recognition, historical revisability, and ontological restraint. The method is reconstructive and register-sensitive. It applies the three-register architecture developed in Chapter 4 to the economic domain without converting that architecture into a claim that all economic reality has one metaphysically fundamental form.

Section 12.1 established that economic specificity is historically and problem-relative. The present section adds a second qualification: economic reality should not be identified simply with whatever is currently measurable, legally recognized, priced, recorded, or administratively classified. Those manifestations and recognitions can be exceptionally important because they organize action and can become causally efficacious in their own right. Their importance does not make them exhaustive. Economic inquiry may need to reconstruct relations that are only partially visible in official categories, and it may need to study how categories themselves participate in producing the economic realities they purport to describe. Historical work on the construction of the modern economy as a governable object, the institutional production of statistical comparability, and the historical formation of classificatory objects illustrates why this distinction matters (Mitchell 1998; Desrosières 1998; Hacking 2002).

Table 12.2 summarizes the principal distinctions used in this section. The table is analytical rather than exhaustive. A single economic phenomenon can occupy several rows simultaneously, and the relevant resolution can change with the inquiry.

12.2.1 Relational Emergence of Economic Reality

Chapter 4 introduced *relational reality* as a register in which configurations can acquire sufficient persistence, stability, and causal efficacy to function as real conditions of later processes without requiring a claim that the configuration is metaphysically fundamental. Chapter 4 developed this criterion in domain-general form through its account of relational reality. Economic reality can be approached as a domain-specific application of that idea: an economic formation becomes relationally real for an inquiry when its organization makes a material difference to economically relevant possibilities, actions, expectations, constraints, capacities, or

Table 12.2: Analytical dimensions of economic reality in the present GRE framework. The distinctions separate relational emergence, manifestation, institutional recognition, and historical revision while allowing them to interact recursively.

Dimension	Analytical question	Illustrative economic forms
Relational emergence	Which patterned relations, constraints, capacities, and differences have become sufficiently organized to matter for subsequent economic processes?	Exchange expectations, credit relations, labor coordination, household provisioning, platform dependence, monetary acceptance.
Stabilization and persistence	Through which recurrent practices, infrastructures, rules, records, expectations, or feedbacks does the configuration retain recognizable continuity?	Contracting routines, settlement systems, organizational procedures, property registries, standards, accounting practices.
Causal efficacy	Which later possibilities, costs, obligations, capacities, expectations, or allocations are altered by the configuration?	Borrowing conditions, access rights, hiring possibilities, prices, investment decisions, exclusion, bargaining positions.
Manifestation	Through which observable, experiential, symbolic, quantitative, or behavioral forms does the configuration become accessible?	Prices, wages, invoices, transactions, queues, inventories, balance sheets, classifications, reported preferences.
Institutional recognition	Which organizations or rule systems assign statuses, rights, obligations, categories, or authoritative records to the configuration?	Legal ownership, corporate personality, licenses, currencies, employment status, eligibility classifications, accounting recognition.
Historical revisability	Which changes in relations, rules, technologies, meanings, or practices could modify or dissolve the configuration?	Institutional reform, technical change, collective action, crisis, category revision, new infrastructures, changing conventions.
Ontological restraint	Which claims concern analytical usefulness and causal reality, and which would require stronger metaphysical commitments?	Relational, network, field, dynamical, or institutional representations used with stated scope conditions.

subsequent relations over the scale and interval being studied.

This formulation permits familiar economic objects to be treated seriously without assuming that their boundaries or identities were given in advance. Money, firms, property, occupations, markets, creditworthiness, household roles, platform statuses, and accounting categories can emerge through histories of practice, recognition, coordination, rule formation, material infrastructure, and representation. Their historical construction does not make them unreal. Once sufficiently stabilized, they can condition what actors can buy, owe, own, inherit, produce, access, refuse, expect, or contest. Berger and Luckmann's account of institutionalization and objectivation, and Searle's analysis of institutional facts and status functions, provide influential but distinct accounts of how socially constituted forms can acquire practical reality (Berger and Luckmann 1966; Searle 1995). GRE draws on the general insight that constituted objects can become causally consequential while leaving the deeper ontology of such constitution open.

Relational emergence is therefore compatible with several pathways. Some eco-

economic formations arise through repeated decentralized interaction. Others depend heavily on legislation, administration, organizational design, technical standards, or material infrastructures. Some emerge through combinations of these processes. A currency can depend on legal authority, settlement infrastructure, accounting convention, taxation, expectation, and repeated acceptance. A market can depend on participants, rules, venues, informational systems, property arrangements, standards, and expectations. A firm's economic reality can involve legal recognition together with organizational routines, assets, contractual relations, authority structures, reputational histories, and continuing coordination. The relevant object is reconstructed through the relations that make it consequential for the question at hand.

This position also preserves scale sensitivity. A relation can be real at one analytical scale while remaining negligible at another. A local reciprocal arrangement can organize household provisioning without appearing in national accounts. A national monetary policy regime can strongly condition local credit while being only one background factor in a particular transaction. A platform rule can be operationally decisive for a seller while constituting one component of a much larger market architecture. Economic reality therefore depends partly on the selected scale, but scale dependence does not reduce the phenomenon to analyst discretion. The inquiry remains answerable to evidence about whether the posited configuration actually constrains, enables, coordinates, or redirects relevant processes.

Definition 12.3 (Relationally real economic configuration). *A relationally real economic configuration* is a historically situated organization of relations, structures, constraints, capacities, differences, practices, or representations that exhibits sufficient persistence and causal efficacy to condition economically relevant processes at a specified scale and over a specified interval.

Definition 12.3 is deliberately conditional. It does not imply that every recurring economic pattern constitutes a stable entity, that every economic category has the same mode of reality, or that the relevant configuration is permanent. It supplies a criterion for taking constituted economic formations seriously while retaining the possibility that their boundaries, mechanisms, and duration will differ across cases.

12.2.2 Stabilization

Stabilization concerns the processes through which an economic configuration acquires enough patterned continuity to become identifiable and consequential across events. It can arise through repetition, expectation, coordination, rule enforcement, technical standardization, material embedding, record keeping, classification, socialization, investment, or feedback from previous outcomes. North's institutional analysis, for example, emphasizes how rules and constraints structure interaction and how institutional change shapes economic performance over time (North 1990). GRE treats such institutional mechanisms as one family among several possible stabilizing processes.

Stabilization should be distinguished from immobility. A configuration can remain recognizable while its participants, manifestations, technologies, and internal relations change. A firm can persist through employee turnover and strategic change; a market can persist while products, participants, and prices vary; a monetary arrange-

ment can retain continuity through technical changes in settlement; a household can remain an economically consequential unit while its membership and internal allocation practices change. What persists is therefore often an organization of relations or a reproducing capacity rather than an unchanged inventory of components.

Economic stabilization can also be recursive. A representation generated within an economic configuration can feed back into later economic relations. Credit scores can affect access to credit; rankings can redirect attention and investment; accounting categories can shape organizational planning; price histories can influence expectations; recognized property titles can support transactions that further reproduce the institutional standing of those titles. Chapter 4 treated this more generally through recursive stabilization and transformation among relational reality, manifestation, and representation. In the economic domain, such feedback makes it especially important to distinguish the stabilization of a practical category from confirmation that the category is descriptively complete or normatively justified.

Stabilization may be uneven. Some components of an arrangement can be strongly institutionalized while others remain contested or informal. A labor relation can be contractually stabilized while expectations concerning effort, care, loyalty, flexibility, or availability remain tacit. A platform can formalize transaction procedures while leaving important dependencies outside its explicit categories. A market can have standardized prices and products while the social relations that enable participation remain heterogeneous. Economic reality can therefore possess a stable public interface together with a more variable relational substrate.

For GRE, the practical question is often which mechanisms sustain the apparent continuity. A pattern maintained by legal enforcement differs from one maintained primarily by convention, infrastructural dependence, repeated reciprocity, reputational expectation, or concentrated control over access. The distinction matters because different stabilization mechanisms imply different vulnerabilities and different pathways of transformation. Later sections on organizations, institutions, platforms, ownership, access, and dependence develop these mechanisms more specifically.

12.2.3 Persistence

Persistence concerns the temporal extension of an economic configuration once some degree of stabilization has emerged. GRE treats persistence as relative to a timescale and resolution. A transaction may persist for minutes, a contractual relation for years, an infrastructure for decades, and an institutional category across several generations. These durations are analytically different, yet each can matter if it conditions subsequent economic histories.

Persistence can be active rather than passive. Maintaining a supply chain requires recurring coordination; maintaining a property regime requires records, adjudication, recognition, and enforcement; maintaining a currency requires settlement, accounting, institutional support, and continuing practices of acceptance; maintaining organizational knowledge requires memory systems, training, routines, or personnel continuity. Apparent stability can therefore depend on substantial continuing work. The absence of visible change at one level can coexist with continuous reproduction

at another.

Historical persistence also creates path dependence. Investments, infrastructures, classifications, contractual forms, skills, expectations, and organizational routines can make some later transformations easier and others more costly. This does not imply that the past mechanically determines the future. It means that earlier events can alter the later field of feasible or attractive possibilities. Chapter 4 developed the historical materiality of ontological categories, while Parts III and IV treated historical trajectories as relevant to inquiry and action. Chapter 12 now applies those commitments to economic architectures in which persistence itself can become a source of capability, dependence, lock-in, memory, or coordination.

Persistence should also be separated from normative desirability. An exploitative arrangement, exclusionary classification, fragile dependency, or concentrated control structure can persist effectively. Conversely, a normatively valued arrangement can remain institutionally fragile. GRE therefore uses persistence as a descriptive and explanatory property. Normative evaluation requires additional considerations concerning value, justice, capability, power, care, rights, ecological consequence, or other relevant commitments developed elsewhere in the book and neighboring domains.

Remark 12.4 (Persistence and viability). Persistence records continuation across a relevant interval. Viability concerns whether a configuration can continue under specified conditions while reproducing the capacities, resources, relations, or functions relevant to the inquiry. Neither property establishes that continuation is normatively desirable. In some settings, the practical objective may concern transformation or dissolution rather than preservation.

Remark 12.4 carries forward the restraint introduced in Chapter 11. GRE can study the conditions under which economic relations persist or remain viable without elevating sustainability, stability, or reproduction into universal goods.

12.2.4 Causal Efficacy

Causal efficacy distinguishes an economically consequential configuration from a pattern that is merely named or observed. Within the present framework, causal language is used broadly enough to include mechanisms represented through statistical, processual, institutional, historical, network, dynamical, interpretive, or other warranted modes of inquiry. The relevant requirement is that the proposed configuration contributes to differences in later possibilities, events, relations, constraints, capacities, or manifestations under the scope conditions of the analysis.

Economic causal efficacy can operate through material channels. Infrastructure can alter transport costs and feasible production locations. Ownership can condition access to assets. Collateral requirements can affect borrowing possibilities. Technical standards can determine interoperability. It can also operate through institutional and symbolic channels. A legally recognized status can create rights and obligations; a rating can alter financing conditions; an accounting classification can change organizational decisions; a market expectation can influence present behavior. Granovetter's analysis of embedded economic action is relevant here because it shows how ongoing relational structures can materially affect economic behavior and institutional

outcomes (Granovetter 1985).

The causal efficacy of representations is especially significant for GRE. A representation can enter the field it describes and thereby change subsequent relations. A forecast can influence expectations, a category can determine eligibility, an index can redirect investment, and a performance metric can reorganize behavior around what is measured. Merton's classic analysis of self-fulfilling prophecy provides an early formulation of a related feedback structure in which a consequential definition of a situation helps generate behavior that changes the later situation (Merton 1948). Chapter 5 and Chapter 11 generalized this issue through performative representation and epistemic events. Economic reality provides many settings in which such feedback becomes empirically consequential.

Causal efficacy remains compatible with partial observability and multiple realization. The same observed price change can arise from different combinations of demand, supply, market structure, expectations, policy, technical disruption, or strategic interaction. The same institutional category can influence actors through different mechanisms across groups or periods. Conversely, a common relational mechanism can manifest differently under different legal or technological arrangements. GRE therefore does not infer mechanism solely from manifestational regularity. Causal claims require evidence appropriate to the question, and the admissible methods remain plural.

A further implication concerns absence and counterfactual structure. Economic conditions can be causally consequential through unavailable options, inaccessible institutions, missing infrastructure, unrecognized rights, or prohibitive constraints. The relevant economic reality is therefore not exhausted by observed transactions. What actors cannot access, cannot credibly choose, or cannot sustain can be as consequential as what becomes manifest in completed exchange. Later sections on capacities, constraints, and access develop this point directly.

12.2.5 Manifestation

Manifestation concerns the forms through which economic reality becomes perceptible, recordable, reportable, measurable, symbolizable, or experientially available. Chapter 4 introduced manifestational reality in domain-general form and developed manifestation mappings, their relational standing, symbolic mediation, and possible non-invertibility. Economic analysis depends heavily on such mappings because many of its empirical objects arrive through prices, quantities, accounts, surveys, contracts, legal records, administrative databases, ratings, classifications, narratives, interfaces, observed behavior, or embodied experience.

Manifestation is indispensable for empirical inquiry, yet no single manifest form should be presumed to exhaust the underlying economic configuration. A wage records one aspect of an employment relation while leaving authority, security, care burdens, scheduling control, workplace knowledge, social meaning, or bargaining dependence only partially represented. A price can condense a market transaction while leaving outside the price many conditions that made participation possible. A balance sheet can make organizational resources and obligations legible under an accounting regime while omitting relationships or capacities that the accounting

framework does not recognize. A national statistic can support comparison while aggregating heterogeneous histories into a common category.

The relation can also run in the other direction: economic relations can become consequential before they acquire standardized manifestation. Informal care, emerging technical practices, unrecorded reciprocal obligations, tacit knowledge, or new forms of digital labor can affect economic possibilities before statistical or legal systems classify them adequately. The later creation of a category can increase visibility, comparability, and governability, but it may also reorganize behavior around the new representation. Historical work on statistical reasoning and economic representation demonstrates how measurement systems participate in constructing fields of comparability and governance (Desrosières 1998; Mitchell 1998).

The non-invertibility of manifestation developed in Chapter 4 is therefore central to substantive GRE. Similar manifestations can be compatible with different relational configurations, and a single relational configuration can produce different manifestations under changing institutional or technological conditions. Reverse inference from an economic indicator to the history and relation that produced it consequently requires additional assumptions and evidence. This issue becomes especially important when policy, credit, employment, welfare, or automated decision systems use manifest variables as proxies for less directly observed capacities or conditions.

Caution 12.5 (Manifestational compression). Economic manifestations can make complex relations operationally tractable while compressing differences that remain relevant to explanation or judgment. GRE therefore treats prices, indicators, classifications, records, and model variables as epistemically consequential manifestations whose adequacy depends on the purpose, scale, history, and relations being studied.

Caution 12.5 does not diminish the importance of measurement. Operational representations can be indispensable for coordination, comparison, testing, and intervention. The caution identifies a reconstruction problem: the more consequential a manifest variable becomes for action, the more important it may be to understand both what it captures and what its production suppresses or leaves unrepresented.

12.2.6 Institutional Recognition

Institutional recognition concerns the processes through which organizations, legal systems, administrative systems, professional practices, accounting regimes, standards bodies, platforms, or other rule-governed structures assign an economically consequential status to a person, object, relation, event, or representation. Recognition can create rights, duties, permissions, exclusions, eligibility, ownership, organizational identity, monetary acceptability, contractual standing, or authoritative records. Searle's account of status functions and collective recognition provides one influential framework for understanding institutional facts, while Berger and Luckmann emphasize the historical processes of institutionalization, objectivation, legitimation, and socialization (Searle 1995; Berger and Luckmann 1966).

GRE treats institutional recognition as one mechanism through which economic reality can be stabilized and transformed. Legal incorporation can make an organization capable of holding assets or entering contracts. Registration can make owner-

ship enforceable against third parties. Licensing can alter who may participate in an occupation or market. Accounting recognition can determine whether an item enters an organization's formal representation of assets, liabilities, revenue, or cost. Administrative classification can open or close access to benefits, credit, procurement, or regulated activities. These recognitions matter economically because they alter practical capacities and constraints.

Institutional recognition and relational reality nevertheless remain analytically distinct. A relation can be economically consequential without formal recognition. Informal work, tacit obligations, community stewardship, unregistered possession, shadow credit, or care relations can structure economic life outside official categories. Conversely, an institution can recognize a formal status whose practical efficacy varies because enforcement, resources, infrastructure, knowledge, or social acceptance are weak. The existence of a category and the effective operation of the relation it names are therefore separate empirical questions.

Recognition can also be contested and plural. Different institutions may classify the same activity differently. Legal, accounting, tax, statistical, platform, and community categories can overlap incompletely. A worker may be treated as an independent contractor under one regime, as economically dependent under another analysis, and as part of a collective production process under a third. GRE should therefore identify which institution performs the recognition, what consequences follow from that recognition, and where competing classifications remain consequential.

Institutional recognition can become recursive. Once a status changes access, rights, expectations, or investment, behavior can reorganize around the status. The resulting pattern can strengthen the practical importance of the classification, even when the original boundary was contingent or contested. Hacking's historical ontology is useful here because it directs attention to how classifications and the objects available for inquiry can emerge together historically (Hacking 2002). GRE extends this concern into economic settings where recognition can change resource flows, incentives, organizational boundaries, and later possibilities.

12.2.7 Historical Revisability

Historical revisability follows from the generative character of economic reality. A configuration that is sufficiently real to organize present economic life can still be transformed by later events. Property regimes change, currencies are replaced, firms dissolve, occupations appear and disappear, markets are reorganized, accounting standards change, household structures evolve, infrastructures are rebuilt, and categories of legitimate economic activity shift. The reality of these formations during a period does not require their permanence.

Revisability occurs through several pathways. Relations can change because participants alter practice. Institutions can revise rules or recognition. Technologies can change feasible forms of coordination and control. New representations can make previously obscure relations visible. Crises can disrupt stabilizing feedback. Political or legal transformations can redistribute authority. Ecological change can alter material constraints. New knowledge can revise the categories through which an economic field is interpreted. These pathways can interact, and their relative importance

is an empirical question rather than a fixed GR sequence.

Historical revisability also applies to the analyst's categories. Terms such as *labor*, *capital*, *market*, *firm*, *household*, *asset*, *platform*, or *data* can acquire different practical meanings as institutions and technologies change. Mitchell's analysis of the historical formation of the modern economy and Hacking's work on historical ontology provide reminders that objects of knowledge can have histories of constitution alongside histories of the phenomena they organize (Mitchell 1998; Hacking 2002). GRE therefore treats its own vocabulary as revisable when changing economic reality makes existing distinctions inadequate.

This revisability should not be confused with unrestricted conceptual relativism. A historical category can still be studied rigorously. Claims about its emergence, scope, causal efficacy, distribution, or transformation remain answerable to evidence. The point is that evidential discipline does not require the category to be timeless. Historical specificity can itself become part of the explanatory burden.

Proposition 12.6 (Historical reality and revisability). *Within the present GRE framework, the historical revisability of an economic configuration is compatible with its relational reality when the configuration exhibits sufficient persistence and causal efficacy over the scale and interval relevant to the inquiry.*

Proposition 12.6 prevents two opposite errors. One would deny reality to constituted or historically contingent economic forms because they could have been otherwise. The other would treat present institutional forms as natural or permanent because they are currently stable and consequential. GRE instead studies how contingency can become structured, how structure can become causally effective, and how causally effective structures can later transform.

12.2.8 Ontological Restraint

Ontological restraint governs the interpretation of every preceding subsection. GRE uses relational emergence, stabilization, persistence, causal efficacy, manifestation, institutional recognition, and historical revisability as analytical resources. Their usefulness does not establish that economic reality is ultimately composed of relations, fields, networks, events, operators, institutions, or any other single class of object. Chapter 4 called this stance ontological suspension and clarified the methodological standing and limits of GRE's ontological claims.

The restraint is particularly important because later chapters employ formal languages inspired by several disciplines. A network representation can capture connectivity, brokerage, dependence, or bottlenecks. A dynamical model can represent trajectories and transitions. A field representation can describe distributed conditions. Operator or event-complex formalisms can organize histories and transformations. Each can become analytically powerful under suitable assumptions. None acquires ontological priority merely because its mathematics is coherent or its predictions are useful.

Ontological restraint also protects economic plurality. Property, money, organizations, households, markets, care relations, platforms, infrastructures, knowledge, and ecological conditions need not share one mode of constitution. Some depend

strongly on legal recognition; some rely more heavily on practice and convention; some are materially constrained; some are technologically mediated; most combine several mechanisms. GRE can therefore compare them through a common relational-generative vocabulary while allowing the substantive ontology of each case to remain heterogeneous and partly open.

A restrained ontology still permits strong local claims. An empirically supported analysis can establish that a particular classification affects access, that an infrastructure creates a bottleneck, that a contractual arrangement stabilizes a dependency, or that a representation changes subsequent behavior. The restraint concerns the movement from such warranted local findings to claims about ultimate reality. It does not require withholding conclusions that are supported within clearly stated scope conditions.

Remark 12.7 (Economic reality as an empirical and theoretical responsibility). Calling an economic configuration relationally real creates an explanatory responsibility. The inquiry should identify the relevant scale and interval, the relations or structures that sustain the configuration, the manifestations through which it is accessed, the mechanisms through which it becomes causally consequential, and the conditions under which the configuration may transform. The designation is therefore a research commitment rather than a metaphysical shortcut.

Remark 12.7 provides the bridge to the remainder of Chapter 12. Economic reality has now been specified as historically constituted yet capable of persistence and causal efficacy, accessible through incomplete manifestations, often mediated by institutional recognition, and open to later transformation. Before the chapter specializes this reality into economic subjects, entities, relations, and other substantive forms, Section 12.3 makes explicit the domain-general ontological coordinates through which those later objects are organized. That coordination clarifies how constraint, change, structure, difference, entity, event, relation, property, state, and process enter the economic architecture without assigning any one of them universal priority.

12.3 Ontological Coordinates of Economic Architecture

The role of this section is to make explicit the ontological organization that guides the remainder of Chapter 12. Its objective is to show how the economic object architecture developed in this chapter relates to the domain-general Generative Relational (GR) distinctions of constraint, change, structure, and difference, together with the emergent analytical forms of entity, event, relation, property, state, and process. The discussion proceeds from these two layers to their economic specification, their many-to-many correspondence with later chapter sections, and several categories that require particular care in economic use. The method is reconstructive rather than foundational: the section does not introduce a new ontology for economics, and it does not treat the listed categories as metaphysically final. It provides a domain map that helps readers understand why the later economic concepts appear, how they are related, and where additional concepts may become necessary.

The need for this map follows from the architectural objective of the chapter.

Terms such as organization, market, ownership, labor, access, dependence, institution, or allocation are not situated at one uniform ontological level. A market can be represented as a relational configuration, a structure, a historical process, a locus of events, and a state of an economic field at a selected analytical cut. An organization can function as an entity at one scale while being reconstructed internally as a changing structure of relations, roles, properties, states, and processes. The same economic phenomenon can therefore require several ontological coordinates at once. A one-to-one taxonomy would conceal this compositional character.

12.3.1 Domain Specification of GR Ontology

GR uses a deliberately restrained ontological vocabulary. At a preliminary analytical layer, *constraints*, *changes*, *structures*, and *differences* provide general resources for describing how a configuration is organized and how it can vary. At a more articulated layer, *entities*, *events*, *relations*, *properties*, *states*, and *processes* provide recurrent object forms through which histories can be reconstructed. Earlier parts of the book treated these categories as analytical resources under ontological suspension rather than as proof of a final metaphysical inventory.

Economic specification gives these categories domain content. A constraint can appear as a material limit, an institutional rule, a financial commitment, a technical dependency, a time requirement, or a relational barrier. A change can appear as transfer, entry, exit, learning, reclassification, price adjustment, organizational reconfiguration, institutional reform, or dissolution. A structure can appear in ownership, governance, infrastructure, network position, market organization, household provisioning, or institutional arrangements. A difference can appear in role, status, capability, access, history, resource position, exposure, or representation without necessarily constituting an asymmetry or hierarchy.

The emergent object forms are specified in the same way. An entity can be a person, firm, household, account, asset, organization, or other stabilized economic object relative to the inquiry. An event can be a transaction, recognition, default, hiring, dismissal, entry, exit, transfer, policy enactment, classification, allocation, or other selected occurrence that changes or records an economically relevant configuration. A relation can be exchange, labor, ownership, care, credit, authority, trust, dependence, or another economically consequential connection. A property can describe an attributed characteristic of an entity, relation, or configuration, such as a resource holding, legal status, capability, centrality, access condition, or exposure. A state can represent a selected configuration at an event-relative or temporal cut. A process can represent temporally extended and structured change, such as production, circulation, learning, institutional reproduction, labor, coordination, or reorganization.

These economic specifications remain scale- and purpose-sensitive. The same object can occupy different ontological roles at different resolutions. A long-term contractual relation can be modeled as a relation between two firms, as an entity-like object within a portfolio of contracts, as a state within a larger supply configuration, or as a process constituted by negotiation, performance, revision, and enforcement events. The analytical role should therefore be stated through the question and mechanism under study.

Table 12.3: Preliminary GR coordinates and their principal economic specifications in Chapter 12. The section loci identify recurrent concentrations rather than exclusive ownership of a category.

GR category	Economic specification	Principal chapter loci
Constraint	Conditions that restrict, channel, condition, or make costly specified economic actions, relations, or transformations.	Economic reality and stabilization (Section 12.2); capacities and constraints (Section 12.17); access (Section 12.18); dependence (Section 12.22); generative potential (Section 12.27).
Change	Economically consequential alteration in configuration, relation, status, position, resource, representation, or feasible history.	Entity and configuration transformation (Sections 12.5 and 12.8); transfer and circulation (Section 12.20); historical architecture (Section 12.26); allocation (Section 12.28).
Structure	Patterned organization through which relations, positions, rules, boundaries, and dependencies acquire recurrent economic significance.	Relational configurations (Section 12.8); organizations, institutions, markets, households, and infrastructures (Sections 12.11–12.15); topology and fields (Section 12.25).
Difference	Non-identity among positions, histories, roles, capacities, properties, states, or relations that can become economically consequential.	Heterogeneous subjecthood (Section 12.4); boundaries and membership (Section 12.9); differentiated access (Section 12.18); asymmetry (Section 12.23); differentiated generative potential (Section 12.27).

12.3.2 Primitive Coordinates of Economic Architecture

Table 12.3 summarizes how the four preliminary GR coordinates recur in the economic architecture developed in this chapter. The loci are illustrative. Each coordinate appears across several sections, and a later economic concept may combine several coordinates simultaneously.

Difference deserves particular care because it is more general than asymmetry. Two economic subjects can differ in role, history, institutional status, temporal position, relation-form, or representation without possessing an ordered advantage or disadvantage. Asymmetry, developed later in Section 12.23, is one possible organization of difference under a specified dimension. The primitive category therefore keeps open forms of heterogeneity that cannot or should not be ranked on one scale.

Constraint also has broader scope than prohibition. A condition can constrain by raising cost, delaying action, narrowing feasible conversion, shaping coordination, requiring complementary resources, or changing the histories that remain accessible. Some constraints can simultaneously enable stable interaction. Their economic role depends on the configuration and horizon in which they operate.

12.3.3 Emergent Economic Object Forms

The six emergent analytical forms provide a more articulated grammar for economic reconstruction. Table 12.4 identifies their working economic interpretations

Table 12.4: Emergent GR object forms and their economic specification in Chapter 12. A single empirical object can legitimately occupy several rows at different scales or for different questions.

Object form	Working economic interpretation	Principal chapter loci
Entity	A sufficiently stabilized and trackable economic object relative to a stated inquiry and resolution.	Economic subjects and entities (Sections 12.4–12.5); organizations and other stabilized forms (Sections 12.11–12.15).
Event	A selected occurrence in an economic history through which a relevant configuration is changed, recognized, recorded, or made consequential.	Event-historical subject and entity representations (Sections 12.4–12.5); transfers and circulation (Section 12.20); epistemic events (Section 12.24); historical architecture (Section 12.26); allocation (Section 12.28).
Relation	An economically consequential connection or conditioned co-position among subjects, entities, roles, rules, resources, or processes.	Economic and higher-order relations (Sections 12.6–12.7); configurations and internal–external coupling (Sections 12.8–12.10).
Property	An attributed characteristic of an economic entity, relation, event, state, process, or configuration whose relevance is specified by the inquiry.	Resources, capacities, access, ownership/control, dependence, asymmetry, and topological position (Sections 12.16–12.25).
State	A selected representation of an economic configuration at a specified event-relative or temporal cut, including the relevant relations, positions, properties, and constraints.	Economic reality (Section 12.2); relational configurations (Section 12.8); market, institutional, access, and field conditions (Sections 12.12–12.25).
Process	A temporally extended organization of changes and events whose continuity or mechanism is analytically relevant.	Production, labor, transfer, circulation, coordination, learning, institutional reproduction, historical transformation, and allocation (Sections 12.6, 12.11–12.28).

and principal loci in the chapter. The categories remain mutually composable rather than mutually exclusive.

The table does not imply that economic analysis should encode each case in all six forms. A price adjustment can be treated as an event when the timing of change is central, as a state variable in a quantitative model, as a property of a market observation, or as one component of a longer adjustment process. The appropriate representation depends on the explanatory task and available evidence.

12.3.4 Many-to-Many Ontological Correspondence

The relationship between GR ontology and substantive economic concepts is many-to-many. A market, organization, household, platform, property regime, or labor arrangement usually combines several ontological forms. Conversely, one ontological form can be instantiated through many economic objects. This compositional relation is important because it prevents the chapter from treating familiar economic nouns as ontologically homogeneous.

Proposition 12.8 (Many-to-many ontological correspondence). *Within the present GRE architecture, the mapping between domain-general ontological coordinates and economic concepts is generally many-to-many. An economic concept may combine several ontological forms, and the same ontological form may be realized through heterogeneous economic objects. Analytical adequacy therefore depends on identifying which forms and mechanisms matter for the question rather than assigning each concept to a single ontological class.*

Proposition 12.8 gives the chapter an organizational principle. Sections on organizations, institutions, markets, households, infrastructures, resources, ownership, labor, coordination, and representation should be read as domain-specific configurations assembled from more general ontological resources. Their section boundaries serve exposition and inquiry; they do not imply that economic reality is naturally partitioned into twenty-eight independent kinds.

This principle also supports ontological restraint. A network representation can emphasize relations and structure; an event-complex representation can emphasize events, histories, and higher-order composition; a state-space representation can emphasize properties and state transitions; an institutional history can emphasize rules, processes, and changes. GRE can use several of these representations for the same economic field when they disclose different mechanisms, provided their scopes and translations remain explicit.

12.3.5 Economic Events and Event Histories

Events deserve explicit treatment because the historical orientation of GR cannot be reconstructed only from stable entities and relations. An economic event is a selected occurrence whose role in an inquiry is to mark or enact an economically relevant change, recognition, commitment, observation, transfer, decision, or transformation. Event boundaries are analytical and evidential: a transaction can be represented as one event at one scale and as a process containing negotiation, authorization, settlement, delivery, and recording events at another.

Economic time can consequently be represented through partial order among events where scalar clock time does not capture the whole structure. Contract authorization can precede settlement; institutional recognition can precede access; an informational event can precede a decision; two geographically separated production events can remain unordered relative to one another while both precede a later assembly event. Clock time can be attached when available, while precedence, dependence, and generative accessibility remain analytically distinguishable.

The event perspective also clarifies why the chapter repeatedly treats histories as

consequential. A present ownership status, credit position, organizational role, market access condition, or institutional classification can depend on event history even when the current manifested state appears identical to another case. Event histories therefore supply causal and interpretive information that a static economic state may compress.

12.3.6 Economic Properties, States, and Processes

Properties, states, and processes are present throughout economic analysis even when they are not named explicitly. Their separation helps prevent several common compressions. A *property* is an attributed characteristic whose relevance is stated relative to an object and inquiry. A resource holding, legal status, access condition, capability, centrality measure, liability, membership category, or exposure can function as an economic property. GRE does not presume that such properties are intrinsic; many are relational, institutional, historical, or representationally produced.

An economic *state* is a selected representation of a configuration at a specified temporal or event-relative cut. A state can include entities, relations, properties, constraints, and institutional conditions. It is therefore a representation of what is taken to obtain at that cut rather than a complete inventory of economic reality. Two configurations can share selected state variables while differing in histories, latent relations, unobserved constraints, or transition potentials.

An economic *process* is a temporally extended organization of changes and events for which continuity, sequencing, mechanism, or reproduction matters to the inquiry. Production, labor, care, circulation, institutional reproduction, organizational learning, coordination, market formation, and allocation can each be represented as processes at an appropriate resolution. A process can contain events and pass through several states while also transforming properties, relations, or entities.

Remark 12.9 (State–history non-equivalence). A state description can be sufficient for some economic questions while remaining insufficient for questions whose mechanisms depend on trajectory, sequence, accumulated obligation, institutional memory, or path dependence. GRE therefore preserves both state-based and event-historical representations where the distinction changes explanation.

12.3.7 Chapter-Level Ontological Correspondence

Table 12.5 provides a higher-level map of the chapter’s organization. It shows why the sequence begins with economic specificity and reality, develops object and relational forms, then turns to stabilized social configurations, capacities and positions, representation, scale and history, and finally generative potential and allocation. The rows are architectural blocks rather than ontological levels.

This map explains the chapter’s ordering without converting it into a rigid derivation tree. Later sections can draw on earlier object forms, and later economic cases can reveal that a category introduced earlier requires revision. The organization is therefore cumulative in exposition while remaining recursive in theory.

Table 12.5: Chapter 12 architectural blocks and their principal ontological emphasis. The mapping is deliberately many-to-many and does not imply exclusive correspondence.

Chapter block	Principal ontological emphasis	Economic function
Economic specificity and reality (Sections 12.1–12.3)	Constraint, change, structure, difference; status of emergent objects	Establishes what counts as economically relevant, what kind of reality is being attributed, and how the GR ontology is economically specified.
Subjects, entities, relations, and configurations (Sections 12.4–12.10)	Entity, relation, event, structure, difference, state	Constructs the principal economic objects and relational compositions used by later sections.
Organizations, institutions, markets, households, and infrastructures (Sections 12.11–12.15)	Structure, entity, relation, property, process	Examines recurrent stabilized social-economic forms through which collective economic activity is organized.
Resources, capacities, access, ownership, transfer, labor, coordination, and asymmetry (Sections 12.16–12.23)	Property, relation, constraint, difference, process, change	Describes economically consequential positions, capabilities, flows, dependencies, and transformations.
Representation, topology, scale, and history (Sections 12.24–12.26)	Property, state, relation, event, process, structure	Develops representational and historical languages for reconstructing complex economic configurations.
Generative potential and allocation (Sections 12.27–12.28)	Change, process, event, constraint, difference, state transition	Examines how present architecture conditions later possibilities and how situated allocation can alter that architecture.

12.3.8 Coverage and Open Extension

The ontological map also provides a way to identify underdeveloped concepts. Entity and relation receive direct and extensive treatment in the chapter. Event, property, state, and process are distributed across many sections and therefore require the explicit coordination supplied here. Difference appears throughout heterogeneity, boundaries, access, asymmetry, and generative potential; the present section clarifies that difference is broader than ordered asymmetry. Change and constraint likewise cut across the chapter rather than belonging to one local section.

The map should not be read as evidence that the ten coordinates exhaust economically relevant reality. New technologies, ecological relations, forms of collective agency, legal structures, symbolic practices, or scientific developments can motivate additional domain categories or revisions of the present ones. Some economic inquiries may also require concepts whose disciplinary standing remains partly external to economics, including legal validity, political authority, cultural meaning, ecological integrity, or phenomenological experience. GRE can relate to those concepts without converting them automatically into economic properties.

Remark 12.10 (Open economic ontology map). The correspondence developed in this section is a provisional organizational map for GRE. It clarifies how the present chapter instantiates existing GR categories and where those categories enter economic analysis. It does not establish that the map is complete, that every economic problem requires every category, or that future GRE work should preserve the present partition unchanged.

With this ontological coordination made explicit, the remaining sections can introduce economic subjects, entities, relations, configurations, institutions, resources, and processes as domain-specific constructions whose roles can be located within the broader GR architecture without being reduced to it.

12.4 Economic Subjects

The role of this section is to specify how Generative Relational Economics identifies the configurations that can occupy economically consequential positions of participation, agency, exposure, dependence, entitlement, obligation, representation, and decision. Its objective is to develop a plural and historically revisable account of economic subjecthood that is broad enough to include persons and collective formations while preserving important differences among human persons, households, organizations, communities, institutions, public authorities, artificial agents, and non-human participants. The discussion proceeds from these heterogeneous subject forms to conditions of comparability, historical-relational representation, and one optional 2-complex model of subject histories. The method is reconstructive and scope-sensitive. Economic subjecthood is treated as an analytical role whose relevance should be justified for the inquiry at hand, while moral standing, legal personality, experiential capacity, causal agency, institutional authority, and computational action remain distinct dimensions unless an argument establishes a relation among them.

Section 12.2 described economic reality as historically constituted yet capable of persistence and causal efficacy. The present section asks which configurations within such a reality can meaningfully be treated as subjects of economic analysis. Conventional economic models often begin with already individuated consumers, workers, firms, governments, or households. Those abstractions can be highly productive when their assumptions fit the problem. GRE adds a prior reconstructive question: which configuration is being treated as the relevant subject, through which relations is that subject stabilized, what capacities are attributed to it, and what heterogeneity is suppressed when it is represented as a single unit? Granovetter's critique of atomized economic action and Sen's capability-oriented emphasis on substantive opportunities both motivate attention to the relational conditions under which economic agency is exercised (Granovetter 1985; Sen 1999).

Table 12.6 summarizes dimensions that can matter when subjecthood is attributed in economic inquiry. The dimensions are neither jointly necessary nor jointly sufficient in every application. They function as an analytical checklist for avoiding premature equivalence among heterogeneous subject forms.

The table makes one discipline especially important. A configuration can be a use-

Table 12.6: Selected dimensions for reconstructing economic subjecthood. The dimensions are analytically separable and can be distributed differently across persons, collective formations, institutions, artificial systems, and non-human participants.

Dimension	Analytical question	Illustrative manifestations
Participation	Through which processes does the configuration enter economically consequential relations?	Labor, exchange, care, production, consumption, contribution, regulation, stewardship, computation.
Capacity	Which actions, transformations, refusals, adaptations, or forms of coordination are feasible for the configuration?	Choice, bargaining, production, learning, rule application, resource mobilization, reconfiguration.
Exposure	Which costs, risks, constraints, losses, or dependencies can be borne by or transmitted through the configuration?	Income loss, debt, displacement, liability, ecological exposure, infrastructure dependence.
Recognition	Which statuses, identities, rights, claims, or categories are assigned by relevant institutions or communities?	Legal personhood, household status, membership, citizenship, organizational role, account identity.
Representation	Who or what can speak, decide, transact, or record on behalf of the configuration?	Authorized officers, household representatives, delegates, algorithms, trustees, public agencies.
Responsibility	Under which conditions can duties, accountability, liability, or answerability be attributed?	Contractual responsibility, fiduciary duty, administrative responsibility, professional accountability.
Experience and welfare	Does the inquiry concern lived experience, suffering, flourishing, preference, need, or capability?	Human welfare, care, deprivation, animal welfare, experienced insecurity.
Historical continuity	Which events, relations, memories, records, and transformations make the subject identifiable across time?	Personal trajectory, organizational succession, household change, institutional memory, model updates.

ful economic subject for one purpose without satisfying every other dimension of subjecthood. A corporation can enter contracts and hold assets without having human experience. A household can be treated as a unit of provisioning while containing members with divergent preferences and unequal authority. An algorithm can execute economically consequential actions while responsibility remains with persons or institutions that design, authorize, deploy, supervise, or rely on it. An ecosystem can condition economic possibilities and become an object of stewardship without thereby becoming equivalent to a legal person, a human decision maker, or a computational agent. GRE therefore uses subject language with explicit scope conditions.

Definition 12.11 (Economic subject). Within the present GRE framework, an *economic subject* is a historically situated configuration that is treated, for a specified inquiry, as occupying one or more economically consequential positions of participation, capacity, exposure, claim, obligation, representation, dependence, or decision. The attribution of subjecthood should identify the relevant dimensions and should not imply equivalence across dimensions that the inquiry has not established.

Definition 12.11 is intentionally permissive at the level of analytical entry and re-

strictive at the level of inference. It allows economic analysis to follow consequential participation beyond the individual person while requiring the analyst to state what kind of subjecthood is actually being attributed. The following subsections develop this discipline across several recurrent subject forms.

12.4.1 Persons

Persons remain a central economic subject because economic processes can affect their opportunities, labor, consumption, care, security, knowledge, time, health, mobility, obligations, and capacity to participate in collective life. GRE does not reduce personal subjecthood to preference expression or market choice. A person can occupy several economic positions simultaneously: worker, caregiver, debtor, owner, tenant, learner, consumer, citizen, family member, creator, beneficiary, contributor, or participant in informal relations that are only partially represented in conventional economic categories. Which positions matter depends on the inquiry.

A relational treatment of persons does not dissolve individuality. It asks how personal capacities and constraints are partly constituted through relations with other persons, organizations, institutions, infrastructures, technologies, legal statuses, environments, and accumulated histories. Sen's capability approach is relevant because it distinguishes resources from the substantive opportunities that persons are actually able to realize and emphasizes the role of social arrangements in expanding or constraining those opportunities (Sen 1999). GRE extends the same caution to relational position: identical nominal resources can have different practical significance when access, knowledge, recognition, dependency, care burdens, mobility, institutional treatment, or social position differ.

Personal economic subjecthood is also historical. Skills are acquired; debts accumulate or are discharged; reputations develop; legal statuses change; family responsibilities emerge; health and mobility can vary; occupational identities form; institutional classifications can open or close future possibilities. A snapshot representation can therefore omit causal structure carried by trajectory. Later subsections formalize this point through historical-relational subject representations.

The person also illustrates why dimensions of subjecthood should remain differentiated. Human persons can possess lived experience, moral claims, needs, preferences, capabilities, and forms of vulnerability that are not implied by the fact that another configuration can transact or optimize. GRE's willingness to model organizations, artificial systems, or ecological configurations as economically consequential subjects under specified questions does not place them on a common moral or phenomenological scale. Those further comparisons require independent argument.

12.4.2 Households

Households can function as economic subjects when provisioning, residence, care, pooling, saving, consumption, inheritance, risk sharing, or interdependent decision-making is organized at a household level. Statistical systems also frequently use households and institutional units as basic units of economic description, although the specific definitions vary by purpose (European Commission et al. 2009). For GRE,

household subjecthood is therefore neither merely statistical nor automatically substantive. It is reconstructed from the relations that make household-level coordination economically consequential for the question being studied.

Households often combine several mechanisms that are analytically distinct: shared residence, kinship, care, income pooling, joint consumption, authority, dependency, reciprocal obligation, emotional attachment, legal status, and intergenerational transfer. These mechanisms need not coincide. A household can contain several earners who control resources separately; people can share care obligations without co-residence; members can depend on resources controlled by others; migration can distribute a household across jurisdictions; digital and financial infrastructures can sustain collective provisioning across distance. Treating the household as a single subject can therefore be useful at one resolution and misleading at another.

Internal heterogeneity deserves particular attention. A household-level budget or consumption measure can conceal differences in access, time use, bargaining position, exposure, or sacrifice among members. The analyst should therefore distinguish claims about the household as a coordinating configuration from claims about the persons within it. Household subjecthood can be valid for studying joint constraints or collective provisioning while individual-level subjecthood remains necessary for questions concerning welfare, autonomy, burden, or unequal internal allocation.

The household also illustrates nested subjecthood. A person can be a subject within a household; the household can be a subject within credit, housing, tax, welfare, or community relations; and several households can participate in larger kinship, neighborhood, or commons arrangements. GRE therefore permits multiple levels of subject representation where the relations among levels remain explicit.

12.4.3 Organizations

Organizations can become economic subjects when coordinated structures allow them to hold resources, form plans, enter agreements, allocate tasks, maintain records, learn, represent members, incur obligations, or act through authorized roles. Economic and legal traditions have long recognized that firms and other organizations cannot always be analyzed adequately as momentary aggregates of individual transactions. Coase's classic analysis of the firm addressed the coexistence of organizational coordination and market exchange, while organizational law can stabilize entities through asset partitioning and standardized legal capacities (Coase 1937; Hansmann and Kraakman 2000).

GRE treats organizational subjecthood as historically produced through coordination, role differentiation, authority, memory, resources, boundaries, and external recognition. An organization can persist through turnover of members because records, routines, assets, contracts, names, governance structures, technical systems, and external expectations reproduce some continuity. This persistence can justify treating the organization as a subject for questions concerning investment, liability, strategy, production, bargaining, learning, or institutional interaction.

Organizational subjecthood remains internally structured. A statement such as "the firm decided" can summarize a process involving boards, managers, employees,

advisers, shareholders, algorithms, contractual constraints, legal duties, and inherited routines. The summary may be appropriate at one analytical scale, but it should not erase the decision architecture when responsibility, conflict, agency, or distribution within the organization matters. The same applies to universities, cooperatives, associations, charities, unions, foundations, and other organized formations.

Organizations can also exhibit partial or contested subjecthood. A loosely coordinated network may act collectively in some settings while lacking durable centralized representation. A project consortium may hold joint commitments for a limited period. A decentralized digital organization may distribute decision rights across code, token holders, developers, and service providers. GRE does not require a single organizational essence. It asks which mechanisms stabilize collective capacity sufficiently for the organization to become a meaningful economic subject under the selected problem.

12.4.4 Communities

Communities can become economically consequential subjects where shared membership, place, practice, identity, reciprocity, stewardship, knowledge, or governance supports collective capacities that cannot be represented adequately through isolated individuals alone. Commons research is particularly relevant because it demonstrates that groups can develop durable rules for managing shared resources under conditions that differ from both centralized administration and simple market exchange (Ostrom 1990; Ostrom 2005).

Community subjecthood is often less sharply bounded than organizational subjecthood. Membership can be layered, customary, contested, seasonal, geographically dispersed, or based on practice rather than formal registration. Authority can be distributed across elders, committees, norms, reputational structures, technical expertise, or repeated participation. Collective action can emerge without a single permanent representative. These features do not make communities economically irrelevant; they make the terms of subject attribution more dependent on the specific mechanism being studied.

A community can be treated as an economic subject for questions concerning stewardship, shared infrastructure, mutual aid, collective bargaining, cultural production, local development, knowledge preservation, or distribution of common resources. Yet the same community may contain unequal positions, conflicting interests, and internal exclusions. Collective subjecthood should therefore remain compatible with analysis of internal differentiation.

The temporal dimension is also important. Communities can retain memory and obligations across generations even when particular members change. They can also fragment, merge, reconstitute boundaries, or lose the practical conditions that sustained collective action. GRE therefore treats community subjecthood as a historical configuration whose continuity and capacity require empirical reconstruction.

12.4.5 Institutions

Institutions require a more cautious treatment because an institution is not automatically a unified actor. Institutions can be understood as systems of rules, norms, expectations, classifications, procedures, and enforcement arrangements that structure interaction. North's institutional analysis emphasizes humanly devised constraints that shape incentives and economic performance (North 1990). Such structures can be causally powerful without possessing a centralized capacity to decide or act in the same sense as a person or organization.

GRE therefore distinguishes institutional efficacy from institutional subjecthood. A property regime, accounting standard, professional norm, monetary convention, or classification system can alter economic possibilities while lacking a single center of agency. For many questions it is more precise to treat such an institution as relational infrastructure. Later Section 322 develops that architecture directly.

Institution-like formations can nevertheless enter subject positions under certain analytical constructions. A court system, central bank regime, regulatory framework, or university system may be represented as a subject when the inquiry concerns coordinated institutional response, provided that the mechanisms of representation and action are specified. Often the acting subject is an organization or authorized office embedded within a wider institution. The distinction matters because attributing agency to "the institution" can obscure which bodies interpret rules, exercise discretion, bear responsibility, or possess resources.

Institutional subjecthood is therefore highly scope-dependent. GRE permits shorthand when it improves analysis, but the shorthand should remain decomposable. Where causality, responsibility, conflict, or transformation depends on internal structure, the analyst should return from the institutional label to the organizations, roles, rules, practices, and relations through which institutional effects are produced.

12.4.6 Public Authorities

Public authorities occupy distinctive economic subject positions because they can combine organizational capacities with legally constituted powers over taxation, expenditure, regulation, adjudication, licensing, monetary arrangements, public infrastructure, social provision, procurement, or recognition. These capacities can alter economic fields at scales unavailable to many private actors. Their subjecthood therefore cannot be reconstructed solely from resource holdings or preferences; it also depends on jurisdiction, public mandate, procedural authority, and institutional location.

The category is heterogeneous. A ministry, municipality, court, regulator, central bank, public corporation, school district, or transnational public body can possess different mandates, decision structures, territorial scopes, and forms of accountability. "The state" or "government" can be useful aggregate terms, yet many economic processes depend on differentiation among agencies and levels of authority. GRE therefore treats public-authority subjecthood as layered and institutionally specified.

Public authorities can also act simultaneously through several relational modes. They may transact as purchasers, regulate as rule makers, redistribute through taxa-

tion and transfers, provide services, certify statuses, collect information, enforce obligations, finance infrastructure, or coordinate emergency responses. These roles can interact. A procurement rule can reorganize a market; a statistical category can influence eligibility; an infrastructure investment can change spatial economic relations; a legal recognition can create assets or obligations. Subject reconstruction should therefore identify which public capacity is active in the mechanism under study.

Public authority also sharpens the relation between capacity and responsibility. Extensive capacity to alter others' options can generate corresponding questions of authorization, procedural justification, review, and accountability. Those normative and political questions belong partly to later chapters and neighboring GR domains. Chapter 12 limits itself to reconstructing the subject position through which public authority becomes economically consequential.

12.4.7 Artificial Agents

Artificial systems can occupy economically consequential subject positions when they perform actions that enter transactions, allocation, production, coordination, information processing, recommendation, pricing, contracting workflows, or other economic processes. The relevant systems range from simple rule-based automation to adaptive models and multi-agent computational systems. GRE uses the term *artificial agent* functionally in this section. It indicates a system to which a bounded action role is attributed within an economic process; it does not establish consciousness, moral status, legal personality, or independent responsibility.

The distinction between delegated action and autonomous practical standing is central. An algorithm can submit orders, adjust prices, route tasks, screen applications, recommend loans, or allocate computational resources. These actions can affect later economic states. Yet the surrounding architecture can include designers, data producers, model owners, deployers, platform operators, regulators, users, and organizations that determine objectives, permissions, infrastructure, monitoring, and consequences. Treating the artificial system as a subject can simplify the causal model while leaving responsibility located elsewhere.

Artificial subjecthood can also be distributed. A model may generate a recommendation, an automated rule may convert the recommendation into an action, an organization may define thresholds, and a human operator may retain override authority. In such cases, a single "AI decision maker" representation can obscure the composite structure. Chapter 11's treatment of machine-mediated decision support and responsibility distribution therefore remains relevant: economically consequential artificial action should be mapped together with the human and institutional relations that authorize and condition it.

Artificial agents also have histories. Their parameters, software versions, training data, permissions, interfaces, objectives, and institutional roles can change. A system represented as the same named agent across time may therefore embody materially different capacities. Historical-relational representation becomes important when earlier outputs affect later data, later model revisions, organizational reliance, or expectations. Chapter 18 will examine radical human–AI capability asymmetry substantively; the present section establishes only the architectural status needed for

Chapter 12.

Caution 12.12 (Functional artificial subjecthood). Attributing economic subjecthood to an artificial system can be useful for tracing economically consequential action. The attribution should state which capacities are delegated to the system, which permissions and constraints are externally supplied, and where responsibility remains located. Functional agency does not by itself establish experience, moral standing, legal personhood, or independent accountability.

12.4.8 Non-Human Participants

Economic processes depend on many non-human participants whose effects cannot always be represented adequately as passive resource stocks. Soil systems, forests, watersheds, animal populations, pathogens, climate processes, energy systems, and other ecological or material configurations can alter production possibilities, labor conditions, infrastructure viability, health, settlement, risk, and the reproduction of economic activity. Ecological economics has long emphasized relationships between ecological and economic systems, while social-ecological analysis treats resource systems, users, governance arrangements, interactions, and outcomes as mutually connected components (Costanza 1989; Ostrom 2009).

GRE uses *participant* here more broadly than intentional agent. A river can condition transport and settlement without choosing to do so. A crop disease can reorganize prices and labor demand without possessing economic intention. An animal can participate in production, care, companionship, or ecological processes while questions of sentience and welfare introduce dimensions absent from non-sentient systems. These differences should remain visible.

The inclusion of non-human participants serves two analytical purposes. First, it prevents economic architecture from being reconstructed as exclusively interpersonal when material and ecological processes help generate the feasible field. Second, it discourages a simple resource ontology in which every non-human component is represented only through ownership, price, or extractive usefulness. Some non-human configurations have dynamics, thresholds, dependencies, and regenerative conditions that materially constrain economic histories.

Subject terminology should nevertheless be used carefully. In some inquiries, “non-human participant” will be more precise than “economic subject.” In others, especially where the analysis concerns stewardship, legal representation, animal welfare, ecosystem rights, or delegated guardianship, a subject-like representation may clarify which claims or interests are institutionally represented. GRE does not settle these legal, ethical, or metaphysical questions in Chapter 12. It identifies the point at which the choice of representation becomes economically consequential and requires explicit justification.

12.4.9 Heterogeneous Subjecthood

The preceding subsections imply that economic subjecthood is heterogeneous across at least three levels. The first concerns constitution: persons, households, organizations, communities, institutions, public authorities, artificial systems, and non-

human participants are stabilized through different combinations of embodiment, recognition, rules, memory, representation, material continuity, and coordinated practice. The second concerns capacity: they possess different abilities to perceive, decide, act, learn, refuse, authorize, bear loss, or mobilize resources. The third concerns normative and legal standing: the fact that two configurations can affect economic outcomes does not imply equal rights, duties, welfare relevance, responsibility, or moral status.

A heterogeneous framework is preferable to an abstract subject category that silently imports the properties of one subject form into all others. Modeling a firm as maximizing an objective can be useful without implying that it experiences welfare. Treating a household as a decision unit can aid analysis without implying homogeneous preferences. Treating an algorithm as an acting node can aid causal reconstruction without transferring responsibility to software. Treating an ecosystem as economically consequential can correct anthropocentric omission without settling whether the ecosystem possesses independent moral standing.

Heterogeneity also appears within subject classes. Persons differ in capacities, histories, institutional statuses, and dependencies. Organizations differ in governance and purpose. Households differ in membership and internal allocation. Public authorities differ in mandate. Artificial systems differ in autonomy and opacity. Non-human participants differ in sentience, dynamics, substitutability, and ecological role. Economic subjecthood therefore should be indexed to the dimensions that matter for the question rather than assigned through a single binary test.

This approach allows strong comparison where warranted. Two firms can be compared with respect to liquidity or market access. A person and a household can be compared with respect to exposure to an energy-price shock. A human trader and an automated trader can be compared with respect to order-submission speed. Those comparisons remain dimension-specific. GRE resists extending them into global equivalence unless the relevant dimensions have been independently justified.

12.4.10 Conditions of Subject Comparability

Comparability among economic subjects depends on a declared comparison dimension, a compatible scale, and a defensible mapping between the properties being compared. Subject comparability is therefore local to an analytical purpose. A common monetary unit can make expenditures comparable while leaving welfare, need, control, and dependency incomparable. A common legal category can make entities formally comparable while their internal governance differs substantially. A common network metric can compare centrality while saying little about the meaning or legitimacy of the ties that generate that centrality.

At least five conditions deserve attention when heterogeneous subjects are compared. The first is semantic compatibility: the measured property should mean sufficiently similar things across the compared subjects. The second is causal relevance: differences in the property should matter for the mechanism under study. The third is scale compatibility: aggregation or disaggregation should not remove the structure that carries the effect. The fourth is temporal compatibility: measurements should refer to histories or states that can reasonably be compared. The fifth is normative re-

straint: descriptive comparability should not be converted automatically into equivalence of moral standing or entitlement.

Failure of one condition does not necessarily make comparison impossible. It can require a more qualified representation. For example, organizations and persons can both hold monetary assets, but the consequences of an identical asset loss may differ because their obligations, replacement capacities, legal protections, and welfare implications differ. Artificial and human agents can both produce forecasts, but the evaluation of error may differ because responsibility, interpretability, and experiential consequence are distributed differently. A community and a corporation can both control land, yet the historical and normative meaning of control may differ.

Proposition 12.13 (Dimension-specific comparability). *Within GRE, heterogeneous economic subjects may be compared where the inquiry specifies a common analytical dimension and establishes adequate semantic, causal, scalar, and temporal compatibility. Such comparability does not entail equivalence across dimensions that have not been included in the comparison.*

Proposition 12.13 provides a discipline for later chapters. It permits quantitative and formal comparison without requiring the book to flatten persons, organizations, institutions, artificial systems, and non-human participants into one universal agent type.

12.4.11 Historical-Relational Subject Representations

A subject representation should preserve enough history and relational structure to explain the capacities and constraints relevant to the inquiry. Static vectors of attributes can remain useful when the current state is sufficient for the problem. GRE adds historical-relational representations when present possibilities depend materially on event order, accumulated relations, prior classifications, institutional trajectories, or path-dependent commitments.

For a person, relevant history might include education, employment, migration, debt, care responsibilities, health events, legal statuses, network changes, or earlier institutional decisions. For an organization, it might include founding arrangements, acquisitions, routines, investments, liabilities, technical systems, changes in governance, and prior commitments. For an artificial agent, it might include model versions, training or update events, permissions, deployment settings, observed failures, and changes in organizational reliance. For a community, it might include membership transformations, stewardship practices, institutional recognition, conflict, and collective memory.

Historical-relational representation is especially important when two subjects with similar present observables possess different future option sets. Equal current income does not imply equal debt exposure, family obligation, skill trajectory, legal security, or access to credit. Equal organizational revenue does not imply equal contractual commitments, infrastructure dependence, technological capability, or institutional support. Equal model performance at one test point does not imply equal training histories or failure modes. The history can therefore alter the practical meaning of the present state.

A useful representation need not contain the entire past. The problem is selective reconstruction. The analyst identifies events and relations that have plausible relevance to the mechanism under study, documents the basis for that selection, and remains open to revision when omitted history becomes consequential. This follows the broader GRE principle that analytical objects are constructed under a question and remain answerable to evidence.

Historical-relational subjecthood also permits identity to be partly continuous and partly transformed. A household can remain identifiable after membership change; an organization can survive a merger while changing governance; an artificial system can retain a product name after substantial model replacement. GRE therefore treats continuity as a relation among histories, functions, recognition, memory, and causal structure rather than assuming immutable identity.

12.4.12 Optional 2-Complex Representation of Subject Histories

A labeled 2-complex can provide one optional formal representation when subject history involves partially ordered events, relations among events, and higher-order structures that cannot be represented adequately by a single linear sequence. The representation is motivated by the event-historical commitments developed earlier in the book. It is a computational and conceptual device, not a claim that subjects are literally 2-complexes or that every economic inquiry benefits from such a formalism.

For a subject s , let a finite labeled event complex be represented by Equation 12.1.

$$\mathcal{K}_s = (V_s, E_s, F_s, \preceq_s, \lambda_s). \quad (12.1)$$

Here V_s is a set of selected events in the reconstructed history of subject s ; E_s contains selected relational links among those events; F_s contains higher-order cells used when a relation among several events or relations must be represented jointly; $\preceq_s$ is a partial order encoding the event-order relations justified by the inquiry; and λ_s assigns labels or attributes relevant to the economic problem. The labels can record, for example, institutional status, resource position, contractual role, observed state, decision type, or evidential provenance.

The partial order carries a specific analytical role. It permits some events to be ordered where dependence or precedence matters while leaving unrelated or insufficiently ordered events incomparable. A person can receive a credential before entering an occupation, an organization can acquire an asset before pledging it as collateral, or an artificial system can be updated before a later decision episode. Other events may occur on separate branches whose exact global ordering is irrelevant. The formalism therefore avoids forcing every subject history into a single scalar timeline when the empirical structure supports only partial ordering.

The 2-cells have a different role. They can represent higher-order historical structure in which several links jointly constitute an economically relevant episode. A financing arrangement may join borrower, lender, collateral, guarantor, and legal recognition. A household decision can involve several members and shared constraints. An organizational reconfiguration can connect a policy change, a technical system, and multiple roles. In problems where pairwise links are sufficient, F_s can

be omitted and a simpler graph or event sequence should be preferred. Formal complexity should follow analytical need.

A subject state at a selected analytical cut can then be reconstructed from the portion of $\mathcal{K}_s$ lying in its relevant causal or historical past together with current relations to other subjects and infrastructures. GRE does not require that such a state be compressed into one vector. Different models can project the same historical complex into different task-specific state descriptions. A credit model, labor-capacity analysis, welfare inquiry, and organizational-risk model can therefore use different projections while preserving a common provenance structure.

The representation also clarifies how epistemic events can become part of subject history. A classification, diagnosis, rating, credential, legal judgment, model output, or institutional recognition can enter V_s when it changes later options, relations, or representations. The same event may be both epistemic and practically generative. This links Chapter 12 to the epistemic-event architecture developed earlier without requiring every observation to be treated as intervention.

Remark 12.14 (Formal representation and subject pluralism). The event-complex representation is one optional model among many. Attribute vectors, trajectories, networks, process models, qualitative histories, institutional case reconstructions, agent-based representations, or other formalisms may be more appropriate for particular questions. Choice of representation should follow the empirical structure and analytical objective, and results should not be generalized beyond the scope supported by that representation.

Remark 12.14 closes the section by returning to the central discipline of economic subjecthood. GRE can broaden the range of configurations treated as economically consequential subjects while preserving differences in agency, experience, responsibility, recognition, historical constitution, and normative standing. The next task is to distinguish subjecthood from entityhood. Section 315 develops economic entities as stabilized configurations and asks when a configuration can be treated as an identifiable economic entity across changing internal and external relations.

12.5 Economic Entities as Stabilized Configurations

Section 12.4 developed economic subjecthood in terms of heterogeneous capacities for participation, action, representation, exposure, responsibility, experience, and historical continuity. The present section separates that problem from *entityhood*. Its role is to specify when an economically relevant configuration can be treated as sufficiently stabilized and trackable to function as an analytical entity, even where it lacks unified agency or subject status. The objective is therefore modest: to provide a relational and historically revisable account of entity formation, persistence, boundaries, internal structure, external relations, transformation, dissolution, multiple realization, scale, and event history. The argument is conceptual and institutionally informed. It uses legal, accounting, organizational, and relational examples to show that entityhood can be practically real without requiring immutable substance or one universal criterion of identity.

Within GRE, stabilization refers to the maintenance or reproduction of enough

structure for a configuration to be identified across a selected range of events. What counts as “enough” depends on the inquiry. A corporation can remain an identifiable entity while employees, owners, contracts, technologies, and assets change. A household can persist through changes in membership. A market platform can retain continuity across software versions and governance reforms. A fund, project, network, infrastructure system, or administrative unit can become economically trackable even when its legal, functional, and relational boundaries do not coincide. Entity attribution therefore requires explicit criteria of continuity and resolution.

Definition 12.15 (Economic entity). For the purposes of GRE, an *economic entity* is a configuration that an inquiry treats as sufficiently stabilized, differentiated, and historically trackable for the economic mechanism under analysis. Entityhood is attributed relative to specified continuity criteria, boundaries, scale, and evidential purpose; it does not by itself imply subjecthood, agency, legal personality, moral standing, or ontological fundamentality.

Definition 12.15 gives entityhood an analytical role without reducing it to arbitrary labeling. Stabilization can be produced by contracts, organizational routines, material continuity, legal recognition, accounting practice, technical architecture, repeated interaction, collective identification, or combinations of these mechanisms. Some configurations are stabilized strongly enough that many independent practices recognize approximately the same entity. Others remain provisional, contested, or highly dependent on the resolution of the inquiry.

Table 12.7 summarizes the principal dimensions developed in this section. The dimensions provide diagnostic prompts for entity attribution. Different research questions can justifiably privilege different subsets and forms of continuity, so the table does not function as a universal constitutive test.

12.5.1 Entity Formation

Entity formation is the process through which a configuration becomes sufficiently differentiated and reproducible to support stable reference in an economic inquiry. Formation can be explicit, as when an organization is legally incorporated, a fund is constituted, a cooperative adopts governing rules, or a project vehicle is contractually created. It can also be gradual. Repeated exchange, shared infrastructure, coordinated practice, or common dependence can stabilize a configuration before any formal act declares that a new entity exists.

Legal and organizational research provides clear examples of explicit stabilization. Organizational law can create standardized legal persons, allocate ownership and governance rights, and partition organizational assets from the personal assets of owners or managers (Hansmann and Kraakman 2000). These arrangements can make an entity easier to identify across transactions because rights, liabilities, and decision authority become attached to a recognized organizational unit. The legal act matters economically because counterparties, creditors, regulators, workers, and courts can coordinate around the resulting status.

Legal constitution is nevertheless one mechanism among several. Coase’s analysis of the firm frames organizational formation partly through the coordination of transactions under an authority relation where using the price mechanism car-

Table 12.7: Selected dimensions of economic entityhood and corresponding analytical questions.

Dimension	Analytical question	Illustrative sources of stabilization
Formation	Through which processes does a configuration become separately trackable?	Legal creation, repeated coordination, material assembly, contractual linkage, institutional recognition
Persistence	Which continuities support identification through change?	Rules, memory, ownership structure, routines, infrastructure, recognition, recurring relations
Boundary	Which distinctions separate inside, outside, member, asset, obligation, or activity?	Law, accounting, governance, technology, function, spatial organization, relational practice
Internal structure	Which differentiated components and relations reproduce the configuration?	Roles, hierarchy, modularity, workflows, shared resources, communication, technical subsystems
External relations	Which relations sustain, constrain, or transform the entity from outside its selected boundary?	Exchange, regulation, finance, supply, care, knowledge, infrastructure, network position
Transformation	Which changes preserve continuity and which create a successor or different entity?	Merger, reorganization, conversion, migration, recapitalization, technological replacement
Dissolution	Through which processes does trackable continuity cease?	Liquidation, fragmentation, abandonment, legal termination, functional collapse, relational dispersal
Scale	At which analytical resolution does the configuration function as one entity?	Person, household, organization, consortium, sector, platform ecosystem, infrastructure system
Event history	Which ordered events establish the entity's continuity, discontinuity, or reconstitution?	Founding, recognition, acquisition, split, default, redesign, succession, termination

ries costs (Coase 1937). Network forms can stabilize collaboration without reproducing the same hierarchical or ownership structure. Communities can organize shared resources without becoming corporations. Technical infrastructures can acquire durable operational boundaries through standards and interoperability. GRE therefore treats formation as a mechanism-specific process and keeps incorporation as one important route among several.

Formation can also be retrospective. Researchers, accountants, regulators, communities, or participants may recognize that a relatively coherent configuration has emerged only after repeated events reveal continuity. Such recognition can then

strengthen the entity by naming it, measuring it, assigning rights or obligations to it, or designing institutions around it. Recognition and formation can therefore interact recursively: stabilization makes identification possible, while identification can become one mechanism of further stabilization.

A formation account should specify at least the configuration being differentiated, the relations that reproduce it, the events through which continuity became observable, and the practices through which participants or observers began to treat it as one unit. These requirements help distinguish empirically grounded entity attribution from convenient reification.

12.5.2 Entity Persistence

Entity persistence concerns continuity through change. The economically important question is rarely whether every component remains identical. Many entities persist precisely because components can be replaced while selected structures, functions, obligations, recognition relations, or historical linkages continue. An organization can survive personnel turnover; a household can survive changes in residence or membership; an infrastructure can survive component replacement; a digital service can survive substantial code revision.

Persistence therefore requires a stated continuity criterion. Different inquiries can use different criteria without contradiction. A legal inquiry may track charter, registration, or succession. An accounting inquiry may track control over a reporting boundary. A production inquiry may emphasize continuity of coordinated activity. A labor inquiry may emphasize employment relations. A community inquiry may emphasize shared membership practices or memory. A technological inquiry may emphasize service continuity or interface compatibility.

The existence of several defensible criteria makes entity identity potentially contestable. A corporation after a merger can be continuous for contractual purposes while discontinuous for organizational culture. A household can remain one administrative unit while its care relations have been substantially reorganized. A platform can keep the same commercial name while replacing its technical architecture, governance, and participant base. GRE therefore asks which dimension and mechanism of persistence is relevant to the inquiry and how strongly the available evidence supports continuity along that dimension.

Proposition 12.16 (Dimension-relative persistence). *An economic entity may persist across change when the continuity relations relevant to the inquiry remain sufficiently supported. Persistence along one dimension does not establish continuity along dimensions whose stabilizing relations have been substantially transformed.*

Proposition 12.16 supports both precision and revisability. It allows a study to use stable entity identifiers where justified while preserving the possibility that identity must be decomposed when internal transformation matters for causal explanation, responsibility, distribution, or historical interpretation.

12.5.3 Entity Boundaries

Entity boundaries specify which components, activities, rights, obligations, resources, or relations are treated as internal to an entity for a given purpose. Boundaries can be legal, accounting, organizational, technological, functional, spatial, or relational. Their overlap is an empirical matter. A legal entity can contain several operational divisions; a reporting entity can include multiple legal entities; a supply network can coordinate activities across many ownership boundaries; a household can pool some resources while keeping others separate.

The accounting concept of a reporting entity illustrates this scope dependence directly. The IFRS Conceptual Framework permits a reporting entity to be a single entity, a portion of an entity, or more than one entity and does not require the reporting boundary to coincide with a legal entity (IFRS Foundation 2018). This example matters beyond accounting because it demonstrates that economically useful entity boundaries can be constructed according to the information problem while remaining disciplined by explicit inclusion criteria.

Boundaries also perform economic work. Asset partitioning can separate pools of assets and creditor claims; membership rules can determine access to collective resources; technical interfaces can decide which actors can interoperate; platform rules can determine which transactions occur inside a governed environment; jurisdictional boundaries can allocate authority and regulatory responsibility. Boundary analysis therefore concerns both representation and causation.

A GRE analysis should distinguish at least three boundary questions. The first is *descriptive*: which boundary do participants and institutions currently use? The second is *causal*: which boundary actually matters for the mechanism being studied? The third is *analytical*: which boundary permits the inquiry to retain the relevant relations without unnecessary complexity? These boundaries can coincide, but the framework does not presume that they do.

Remark 12.17 (Boundary plurality). Multiple boundaries can be simultaneously valid for different tasks. Their coexistence becomes analytically consequential when conclusions depend on which boundary is selected, especially where costs, benefits, liabilities, risks, capacities, or responsibilities cross the selected perimeter.

Remark 12.17 anticipates later treatment of membership, access, ownership, platforms, and internal–external coupling. Boundary selection therefore forms part of economic explanation and can materially affect the conclusions produced by an analysis.

12.5.4 Internal Structure

Treating a configuration as one entity does not erase its internal structure. Economic entities can contain roles, departments, assets, routines, technical modules, decision rights, internal markets, shared resources, informal relations, and differentiated capacities. These structures often explain how the entity reproduces itself and how external events propagate through it.

Simon describes hierarchy and near decomposability as possible features of complex systems that can support relative stability across levels (Simon 1962). GRE uses

this as a representational resource whose applicability depends on the organization under study. Some entities have strongly modular structures; others are densely coupled, fluid, or difficult to partition. The degree of decomposability is therefore an empirical property.

Internal structure matters whenever aggregate entity-level variables conceal consequential differentiation. A firm can report positive profits while particular units contract. A household can appear solvent while one member bears disproportionate unpaid care. A public authority can appear coherent while agencies pursue conflicting mandates. A platform can function as one commercial service while control over data, models, infrastructure, and governance is distributed across several organizations.

Accordingly, entity-level explanation should remain decomposable. The analyst can work at the entity scale when aggregate behavior is adequate to the question and return to internal relations when coordination, conflict, responsibility, vulnerability, or transformation depends on lower-level structure. This movement across levels prevents analytical convenience from becoming an assumption of internal homogeneity.

12.5.5 External Relations

Entityhood is also sustained through relations that cross its selected boundary. Suppliers, customers, creditors, regulators, infrastructures, communities, ecological systems, knowledge networks, and public institutions can contribute materially to the capacities that appear at the entity level. Granovetter's analysis of embeddedness provides one influential economic-sociological precedent for treating economic action as situated in ongoing social relations (Granovetter 1985).

The distinction between internal and external relations is therefore analytical. Externality to the selected boundary remains compatible with strong causal dependence. A firm may depend on public infrastructure, external finance, standards, professional knowledge, labor markets, and long-term supplier relations. A household can depend on schools, care services, transport, housing markets, kin networks, and welfare institutions. A digital service can depend on cloud infrastructure, data pipelines, application interfaces, device ecosystems, and legal permissions.

External relations can stabilize entityhood by supplying recurring inputs, recognition, legitimacy, finance, demand, information, or coordination. They can also destabilize it through withdrawal, conflict, regulatory change, infrastructure failure, technological substitution, or altered expectations. Entity analysis should therefore record the relational environment required for persistence when that environment is causally significant.

This point places a limit on self-contained entity explanations. An entity can be treated as a unit without being treated as causally closed. GRE uses entity abstraction to manage analytical complexity while retaining the option to reopen the boundary whenever cross-boundary relations materially affect the phenomenon under study.

12.5.6 Entity Transformation

Entity transformation occurs when internal structure, boundary, recognition, function, or external relations change while some continuity remains. Transformation can be incremental, such as changes in membership or technology, or discontinuous, such as merger, conversion of legal form, large-scale restructuring, platform migration, or institutional redesign. The analytical problem is to determine which continuities survive and which mechanisms have been replaced.

A transformation can preserve a label while altering the configuration that gives the label economic meaning. Conversely, labels can change while much of the operative configuration persists. This is one reason GRE separates manifestation and recognition from relational reality. Names, registrations, accounting identifiers, and brands can provide valuable traces of continuity, yet they should be interpreted together with the relations that reproduce the entity.

Transformation also changes the relevance of historical evidence. Performance measured under a previous organizational structure may transport poorly after a merger or technological redesign. Risk estimates based on earlier dependencies may become stale when suppliers or infrastructures change. Responsibility assignments may require reconstruction when decision rights are redistributed. Entity transformation is therefore both an object of description and a change in the epistemic conditions under which the entity can be analyzed.

For longitudinal work, the researcher should document transformation events and state whether continuity is being assumed, tested, or restricted to selected dimensions. This practice makes later claims about trends, persistence, or causal effects more transparent.

12.5.7 Entity Dissolution

Entity dissolution is the loss of sufficient continuity for a configuration to remain usefully trackable as the same economic entity under the selected criteria. Dissolution can occur through legal termination, liquidation, fragmentation, absorption into another organization, abandonment, technical collapse, dispersal of membership, or erosion of the relations that previously reproduced the entity.

Different forms of dissolution need not coincide in time. A corporation can cease operations before legal liquidation is complete. An organization can retain legal personality after losing most of its operational capacity. A community can lose institutional recognition while social relations persist. A platform can shut down a service while contracts, data obligations, creditor claims, or user dependencies remain. Dissolution therefore often has an afterlife.

Residual relations are particularly important economically. Liabilities, warranties, archives, intellectual property, environmental obligations, pensions, debts, data-retention duties, reputational effects, and infrastructural dependencies can survive the entity configuration that generated them. A dissolution analysis that stops at formal termination can therefore miss economically consequential continuities.

GRE treats dissolution as an event-historical process whose consequences can extend beyond the end of entity-level coordination. This mirrors the treatment of exit

in application-dominant praxis: cessation of one organized configuration does not erase the history through which rights, obligations, dependencies, and effects were produced.

12.5.8 Multiple Realization

Multiple realization concerns the possibility that a recognizable economic role, function, or entity type can be sustained by materially different internal configurations. A payment service can be implemented through different technical architectures. A cooperative can use different governance procedures. A household can organize provision through different combinations of paid work, unpaid care, transfers, and shared resources. A reporting unit can encompass different legal structures while serving a comparable informational role.

The concept is useful when comparative analysis would otherwise confuse function with substrate. If several configurations provide similar services or occupy similar institutional positions, a higher-level entity type can support comparison. The comparison remains qualified because similar function does not imply identical capacities, vulnerabilities, power relations, distributional consequences, or histories.

Multiple realization also operates over time within one entity. An organization can preserve selected functions while replacing technologies, staff, routines, or suppliers. In such cases, persistence and multiple realization intersect: continuity is partly achieved through the capacity to alter lower-level components while maintaining higher-level relations or outputs.

Remark 12.18 (Functional similarity and relational difference). Functional or institutional similarity can justify comparison at a selected level while substantial relational differences remain analytically relevant. Multiple realization therefore supports abstraction only to the degree warranted by the research question.

This remark prevents functional equivalence from becoming a claim of structural or normative equivalence. Later analysis of organizations, markets, platforms, ownership, and coordination will repeatedly require this distinction.

12.5.9 Scale-Relative Entityhood

Entityhood changes with analytical scale. A worker can be treated as one economic entity in a labor-market model and as a historically differentiated subject in a study of skills, care, health, or migration. A firm can be one entity in an industry model and a configuration of divisions, contracts, technologies, workers, and governance relations in an organizational analysis. A supply chain can become one operational entity for resilience analysis even though it contains many legally independent firms.

Scale-relative entityhood is compatible with the multilevel structure of complex systems. Simon's account of near-decomposability illustrates why some subsystems can sometimes be analyzed approximately as units while remaining components of larger structures (Simon 1962). GRE extends this methodological point cautiously: the appropriate entity scale depends on the mechanism, time horizon, and cross-level coupling relevant to the inquiry.

Scale selection can change apparent causal responsibility and distribution. A

multinational group treated as one entity can obscure transfers among subsidiaries. A household treated as one unit can obscure intrahousehold inequality. A national economy treated as one system can obscure regional or sectoral asymmetry. Conversely, excessive disaggregation can obscure collective capacity, systemic constraints, network effects, or emergent coordination.

A scale choice should therefore be explicit and revisable. Where conclusions are sensitive to aggregation, the analysis should compare alternative resolutions or state the limits of the chosen scale. This discipline is especially important for later GRE work on multiscale transfer, asymmetry, generative potential, and cross-scale justice.

12.5.10 Event-Historical Entity Structure

An event-historical representation treats entityhood as continuity reconstructed through a sequence or partial order of formation, recognition, transformation, and dissolution events. This perspective complements state-based descriptions. A current entity record can show what exists at a selected date; an event history explains how the present configuration became possible and which continuities support its identification.

Relevant events can include incorporation, acquisition, membership change, licensing, capitalization, contract formation, default, reorganization, infrastructure migration, regulatory recognition, merger, split, succession, or termination. The relevant ordering is problem-dependent. Some events have clear dependence relations, while others can remain only partially ordered. GRE therefore does not require a single universal clock sequence where the empirical problem is better represented through event precedence and branching histories.

The optional event-complex formalism introduced for subject histories in Section 12.4.12 can be adapted to entity histories when higher-order relations among several events are analytically important. A merger, for example, can connect several predecessor entities, contracts, recognition acts, and asset transfers. A platform reorganization can involve technical migration, governance change, contractual revision, and user transition. The present section does not introduce a second formalism because the same representational family can be reused when it earns its place.

Event history also clarifies entity identity after discontinuity. A successor organization can inherit assets, obligations, personnel, records, or legal liabilities without being identical to its predecessor along every dimension. A dissolved entity can remain historically active through outstanding claims or infrastructures. A reconstituted community can recover names and practices while operating under new institutions. These cases are easier to analyze when continuity is represented through specific event and relation pathways that preserve dimension-specific forms of succession and discontinuity.

Remark 12.19 (Entityhood as a revisable analytical commitment). Treating a configuration as an entity is a commitment to a particular level of stabilization, boundary, and historical continuity. The commitment can be revised when new evidence shows that the selected unit conceals relations essential to the question or combines components whose trajectories should be distinguished.

Remark 12.19 completes the separation between subjecthood and entityhood. Economic analysis often requires stable units, yet stability can be reconstructed without converting those units into timeless substances. The next section turns from identifiable configurations to the relations through which economic entities and subjects become connected. Section 316 develops exchange, production, labor, ownership, credit, care, knowledge, trust, authority, dependency, cooperation, and conflict as heterogeneous economic relations whose effects depend on history, institutional setting, and relational configuration.

12.6 Economic Relations

Sections 12.4 and 12.5 distinguished economic subjects from stabilized economic entities. The present section shifts the analytical emphasis from identifiable configurations to the relations through which economic activity is organized, constrained, reproduced, and transformed. Its role is foundational: to establish a heterogeneous vocabulary of economic relations before later sections examine higher-order relations, relational configurations, institutions, markets, resources, ownership, circulation, labor, dependence, and asymmetry in greater detail. The objective is therefore classificatory and relational rather than exhaustive. Exchange, production, labor, ownership, credit, care, knowledge, trust, authority, dependency, cooperation, and conflict are developed as recurrent relation-forms whose concrete meaning depends on history, institutional setting, scale, and the positions of participating subjects. The discussion combines conceptual reconstruction with selected economic and social-theoretical precedents while preserving GRE's ontological suspension and methodological pluralism.

Economic analysis has often privileged particular relations according to its problem setting: exchange and price relations in market analysis, production and labor relations in classical and Marxian political economy, contractual and authority relations in theories of the firm, institutional relations in institutional economics, and embedded social relations in economic sociology. Smith connected division of labor and exchange to the development of productive powers (Smith 1776); Marx analyzed production through historically specific relations among labor, property, cooperation, and capital (Marx 1867); Coase treated the firm partly through the relation between market coordination and direction within an organization (Coase 1937); and Granovetter emphasized that economic action is embedded in ongoing structures of social relations (Granovetter 1985). These traditions motivate a broad relational vocabulary without establishing that one relation-form provides a complete grammar of economic life.

Definition 12.20 (Economic relation). Within GRE, an *economic relation* is a historically situated connection among subjects, entities, practices, resources, representations, or institutions that materially conditions economic capacities, constraints, transfers, obligations, expectations, participation, or future possibilities within the inquiry under consideration. The attribution of an economic relation is analytical and evidential: its form, direction, scale, duration, and boundaries should be specified relative to the mechanism being studied.

Definition 12.20 gives relations causal and historical content without requiring them to be substances. A relation can be formal or informal, episodic or durable, direct or mediated, reciprocal or asymmetric, voluntary or constrained, recognized or weakly institutionalized. It can also change form. A short-term exchange can become a repeated credit relationship; collaboration can generate authority or dependency; care can become contractual labor; knowledge exchange can create intellectual-property claims; conflict can produce a negotiated institution. GRE therefore treats relation-form as a revisable analytical description of a changing configuration.

The relation-forms developed below are also non-exclusive. One employment relation can simultaneously contain exchange of labor for remuneration, organizational authority, knowledge transfer, trust, dependency, cooperation, and conflict. A credit relation can combine ownership claims, legal authority, expectations, information asymmetry, and dependence on future income. Table 12.8 summarizes the selected forms and the principal analytical questions they introduce. The table functions as a vocabulary for inquiry rather than a completed taxonomy.

Proposition 12.21 (Multi-relational composition). *An empirically observed economic connection can instantiate several relation-forms simultaneously, and its consequences can depend on interactions among those forms. Analytical separation is therefore useful for diagnosis, while explanation may require reconstruction of their composition.*

Proposition 12.21 prevents the vocabulary from becoming a rigid classification system. It also prepares the later move to higher-order relations and relational configurations. The remainder of this section introduces each relation-form at a level sufficient for later synthesis while leaving its detailed institutional and normative development to subsequent sections and chapters.

12.6.1 Exchange

Exchange refers to a relation in which parties condition transfers, performances, permissions, or claims upon one another. Market purchase is an important instance, yet exchange also occurs through barter, negotiated service, reciprocal provision, platform-mediated transactions, informal arrangements, and institutionally regulated transfers. Polanyi's account of the economy as an instituted process distinguishes exchange from reciprocity and redistribution and emphasizes that forms of integration depend on institutional organization (Polanyi 1957). GRE therefore treats exchange as one economic relation-form among several rather than as the universal template through which every economic connection should be interpreted.

An exchange analysis should identify what is transferred, how the relevant objects or performances are recognized, how terms are formed, which parties possess bargaining capacity, which temporal sequence governs performance, and which institutions stabilize expectations. Monetary price can summarize part of the relation while leaving other dimensions unresolved. Contractual rights, search costs, quality uncertainty, social reputation, legal enforceability, platform rules, or repeated interaction can materially shape the feasible terms of exchange.

Exchange also carries history. Repeated transactions can create reputation, dependence, relational-specific investment, learned expectations, or informal obligations. A formally identical transaction can therefore have different practical significance

Table 12.8: Selected economic relation-forms and associated analytical questions.

Relation-form	Core analytical concern	Selected dimensions
Exchange	Reciprocal or conditional transfer among differently positioned parties	Object of transfer, valuation, timing, bargaining, reciprocity, institutional setting
Production	Joint transformation of materials, information, capabilities, or services	Inputs, coordination, technology, task structure, residuals, control
Labor	Participation through work, effort, skill, time, or task performance	Remuneration, authority, autonomy, protection, skill formation, recognition
Ownership	Institutionally recognized claims over use, benefit, exclusion, transfer, or control	Claim bundle, legal form, effective control, beneficiaries, obligations
Credit	Present transfer or capacity conditioned by expectations concerning future performance	Time, repayment, collateral, interest, information, enforcement, default
Care	Provision oriented toward maintenance, development, or support of persons and relationships	Need, dependence, time, reciprocity, obligation, compensation, recognition
Knowledge	Creation, access, communication, use, withholding, and transformation of knowledge	Codifiability, tacitness, access, learning, appropriation, provenance
Trust	Reliance under incomplete control or knowledge of another party's future conduct	Vulnerability, expectation, reputation, institutions, monitoring, breach
Authority	Institutionally or relationally recognized capacity to direct, authorize, constrain, or decide	Scope, legitimacy, hierarchy, delegation, contestability, review
Dependency	Reliance in which another relation, resource, or actor materially conditions feasible action	Alternatives, substitutability, switching costs, asymmetry, duration, exit
Cooperation	Coordinated action toward partially shared or mutually compatible purposes	Contribution, reciprocity, governance, learning, surplus, distribution
Conflict	Incompatibility or contestation over resources, rules, recognition, obligations, or trajectories	Stakes, bargaining, power, escalation, institutional mediation, settlement

for a new entrant and a long-term counterpart. The relation may further generate external connections to finance, regulation, infrastructure, or social networks. Granovetter's embeddedness argument is relevant here because observed market transactions can depend on continuing social relations that cannot be reconstructed from price and quantity alone (Granovetter 1985).

GRE accordingly treats exchange as a relational event within a wider configuration. Later chapters can formalize prices, allocation, transfer, and value conversion

where the problem requires them, but the present architecture keeps visible the parties, institutional conditions, histories, and future relations through which exchange becomes economically consequential.

12.6.2 Production

Production refers to relations through which materials, energy, information, knowledge, services, capabilities, or other economically relevant states are transformed through coordinated activity. The relation-form includes technical transformation but extends to the organization of tasks, access to inputs, coordination among participants, control over productive assets, and the distribution of resulting outputs and residual consequences.

Classical political economy linked production to division of labor and the development of productive powers (Smith 1776). Marx placed production within historically constituted relations among labor, property, cooperation, machinery, and capital (Marx 1867). Contemporary production can additionally involve distributed suppliers, platform infrastructures, automated systems, public research, households, care networks, data pipelines, and transnational value chains. These arrangements make production relationally heterogeneous even when the output is represented as one commodity or service.

For GRE, production analysis therefore asks which transformations occur, which subjects and entities participate, which resources and capacities are mobilized, which authority and knowledge relations coordinate the process, and which consequences are carried beyond the immediate production boundary. Productive capacity can be generated through learning, infrastructure, standardization, or collaboration; it can also be depleted through environmental damage, deskilling, exclusion, dependency, or loss of redundancy. These consequences matter because production can reshape later action spaces rather than merely produce a contemporaneous output.

The relation-form remains scale-sensitive. A household meal, a software project, an industrial plant, a scientific collaboration, and a distributed supply network all involve production, yet their coordination mechanisms and relevant subjects differ substantially. Later sections therefore decompose organizations, infrastructures, resources, capacities, labor, and multiscale architecture rather than treating production as one homogeneous process.

12.6.3 Labor

Labor relations connect work, effort, skill, time, task performance, organizational participation, and the institutions through which these activities are recognized and governed. Wage employment is a central case, but economically consequential labor also occurs in self-employment, cooperative production, family enterprises, unpaid household work, care, volunteering, apprenticeship, platform work, and hybrid arrangements. The boundary between labor and adjacent activities is historically and institutionally contested.

A labor relation can contain remuneration, authority, monitoring, skill formation, occupational identity, legal protection, bargaining, care obligations, and dependency

at the same time. The exchange of labor for wages therefore captures only one dimension. Marx's analysis of the labor process emphasizes relations among labor-power, control, cooperation, and production organization (Marx 1867); feminist economics has further shown that economically necessary household and care activities can become obscured when labor is identified primarily with paid employment (Himmelweit 1995; Power 2004).

GRE approaches labor through several questions: who performs which activities, under what authority and contractual conditions; which capacities are exercised or developed; what forms of compensation and protection exist; which dependencies are created; and how participation changes later possibilities for the worker, organization, household, or community. Skill formation can increase future agency while occupational lock-in can narrow alternatives. Stable employment can support planning while concentrated employer dependence can increase vulnerability. These consequences cannot be inferred from wage level alone.

The present subsection provides only the relation-form. A later section on labor and participation develops activity, contribution, paid and unpaid labor, care and knowledge labor, artificial labor, and forms of participation beyond employment in greater detail.

12.6.4 Ownership

Ownership relations organize institutionally recognized claims concerning use, benefit, exclusion, transfer, control, residual income, liability, or succession. Different legal and institutional systems can combine these incidents differently, and effective control can diverge from nominal ownership. GRE therefore treats ownership as a structured relation among claimants, assets, institutions, and affected parties rather than as an intrinsic property residing in an object.

Economic consequences depend on the content and enforcement of claims. Organizational law can separate assets and creditor claims across legal entities, thereby stabilizing economic organization and altering risk allocation (Hansmann and Kraakman 2000). Shared ownership, trusts, cooperatives, public ownership, common-property arrangements, intellectual-property regimes, and platform control illustrate that ownership can distribute rights and responsibilities across several parties. A party can also exercise substantial control without holding conventional title, while a legal owner can face contractual, fiduciary, regulatory, or social constraints on use.

Ownership is historically generative because claim structures shape future access, bargaining, investment, inheritance, exclusion, and control over transformation. Changes in ownership can reorganize relations even where the material object remains unchanged. Conversely, practical use and benefit can change without formal transfer of title. An adequate analysis should therefore specify which incidents of ownership are relevant and distinguish legal recognition from effective relational control.

Later sections examine ownership and control directly. The present role is to place ownership beside other relation-forms so that it is neither treated as the sole foundation of economic structure nor reduced to one binary relation between person and

thing.

12.6.5 Credit

Credit relations connect present access to resources or purchasing capacity with expectations concerning future performance. They therefore organize economic relations across time. A borrower receives current capacity subject to future repayment or performance; a lender accepts exposure on the basis of information, collateral, institutional enforcement, reputation, risk assessment, or other expectations. Credit can support investment, consumption smoothing, innovation, trade, emergency response, and organizational continuity, while also creating durable obligations and dependence.

The economic significance of credit extends beyond the amount transferred. Interest, maturity, collateral, priority, covenants, currency denomination, refinancing conditions, information requirements, and default rules can redistribute future flexibility among parties. Schumpeter treated credit as central to financing new combinations and economic development (Schumpeter 1934). From a GRE perspective, this illustrates how a relation can modify the feasible future of an actor before the productive transformation it supports has occurred.

Credit also depends on representations. Ratings, income records, collateral valuations, histories of repayment, legal identities, and model-generated risk estimates can condition access. These representations may become performative when they alter borrowing terms, investment opportunities, or institutional behavior. The relation therefore joins monetary transfer to knowledge, trust, authority, and legal recognition.

The history of a credit relation can remain consequential after repayment or default through reputation, collateral loss, legal records, organizational restructuring, or changed access to future finance. GRE therefore treats credit as an event-historical relation whose effects can persist beyond the formal duration of the contract.

12.6.6 Care

Care relations concern activities and commitments oriented toward maintaining, supporting, developing, or restoring the capacities and well-being of persons and relationships. They can occur within households, families, communities, markets, public institutions, professional organizations, or mixed arrangements. Care can be paid or unpaid, voluntary or institutionally assigned, reciprocal or strongly asymmetric, episodic or sustained across long periods.

Feminist economics has demonstrated that care and social provisioning can be economically consequential even where conventional accounting or labor categories render them weakly visible (Folbre 1994; Power 2004). Care affects time allocation, labor-market participation, education, health, intergenerational development, household capacity, and the reproduction of future economic subjects. Its analysis therefore cannot be confined to sentimental or private domains when the relevant consequences are economic.

A relational approach also preserves differences among care arrangements. The

same nominal service can have different meanings and effects depending on trust, continuity, professional standards, kinship, reciprocity, obligation, and the recipient's dependence. Compensation can change the institutional form of care without eliminating its relational content. Conversely, unpaid status does not establish voluntariness or equitable distribution of responsibility.

GRE treats care as one relation-form that can intersect with labor, authority, dependency, knowledge, and trust. Its normative evaluation remains situated: the existence of a durable care relation does not by itself establish that its distribution of burden, agency, or recognition is desirable. Later analysis of households, communities, labor, access, and allocation can specify these questions more fully.

12.6.7 Knowledge

Knowledge relations concern the creation, possession, communication, withholding, interpretation, validation, and transformation of knowledge among economically situated subjects and institutions. Their importance arises partly from the uneven distribution of information and expertise and partly from the capacity of knowledge to change production, coordination, bargaining, innovation, and future learning.

Hayek emphasized the coordination problem created by dispersed and incomplete knowledge distributed across different persons (Hayek 1945). Arrow's analysis of invention highlighted uncertainty and appropriation difficulties that distinguish information production from ordinary commodity production (Arrow 1962). Knowledge can also function as a shared resource governed through institutions of access, contribution, preservation, and enclosure (Hess and Ostrom 2007). These traditions point to several relation-forms rather than one uniform object called knowledge.

GRE therefore asks who can know what, through which practices and infrastructures, with what reliability, and under which rights of access, use, secrecy, attribution, or exclusion. Tacit knowledge can remain tied to participation and experience; codified knowledge can travel across organizational or geographic boundaries; proprietary knowledge can support bargaining power; open knowledge can enable distributed learning; algorithmic systems can mediate access while introducing new dependencies.

Knowledge relations are generative in a direct sense because they can alter the capacities of participants. Teaching, collaboration, documentation, imitation, and shared problem solving can create capabilities that persist after an immediate transaction ends. Knowledge withholding or enclosure can likewise constrain future participation. The economic consequences therefore concern both present information and the evolution of who can learn, decide, produce, or contest later.

12.6.8 Trust

Trust relations involve reliance on another party, institution, representation, or process under conditions in which complete monitoring or control is unavailable. Trust can reduce the practical burden of verifying every action, facilitate cooperation, support credit, and make repeated exchange possible. It also creates vulnerability because reliance exposes one party to conduct that cannot be fully guaranteed in ad-

vance.

Arrow identified trust and related social virtues as economically important to exchange and collective organization (Arrow 1972). Ostrom's behavioral work similarly connects trust, reciprocity, and reputation to the possibility of sustained collective action in settings where short-run individual incentives can undermine cooperation (Ostrom 1998). GRE incorporates these insights while distinguishing trust from simple prediction. A person can predict another's opportunism without trusting them; trust involves a willingness to rely under some degree of exposure.

The sources of trust can differ. Repeated experience, reputation, shared identity, professional norms, legal safeguards, guarantees, transparent procedures, auditing, or technical verification can support reliance in different ways. These sources are not equivalent. Institutionally secured reliance can reduce the need for interpersonal trust, while excessive reliance on personal trust can sometimes substitute for weak formal protection. Conversely, formal verification can become costly or incomplete enough that relational trust remains economically consequential.

Trust can also be path dependent. Breach may alter future cooperation beyond the immediate loss, while successful coordination can accumulate reputational and relational capital. GRE therefore treats trust as a historically evolving relation that interacts with knowledge, authority, credit, cooperation, and conflict.

12.6.9 Authority

Authority relations concern recognized capacities to direct, authorize, prohibit, allocate, interpret, adjudicate, or decide within a specified domain. Economic authority appears within firms, households, public agencies, professional bodies, platforms, financial institutions, associations, and other organizations. Its scope can be formalized through law or contract, generated through organizational position, or sustained through convention and expertise.

Coase's analysis of the firm draws attention to coordination in which resource allocation can occur through direction rather than repeated market contracting (Coase 1937). Organizational authority, however, is rarely unitary. It can be delegated, divided, reviewed, contested, or conditioned by rules and professional standards. A manager can direct tasks without owning the organization; a platform can set participation rules without owning participant assets; a regulator can constrain conduct without managing production.

GRE analyzes authority through its scope, basis, duration, reviewability, and relation to affected capacities. Authority can enable coordination where distributed negotiation would be costly or slow. It can also produce dependency, information concentration, strategic silence, or self-reinforcing control. These possibilities should be investigated rather than inferred from the presence of hierarchy alone.

Authority can further become historically sticky. Temporary decision rights may become routine, emergency powers may outlast the conditions that justified them, and technical expertise can become institutionalized into durable gatekeeping. Later sections on organizations, institutions, access, control, and asymmetry develop these mechanisms more fully.

12.6.10 Dependency

Dependency relations arise when one actor's feasible actions, capacities, or continuity depend materially on another actor, resource, institution, infrastructure, or relational configuration. Dependence is therefore relative to alternatives. A relationship can be economically important because exit is costly, substitutes are unavailable, switching requires specialized investment, legal status is tied to the relation, or essential knowledge and infrastructure are concentrated elsewhere.

Dependency should be distinguished from simple connection. A supplier can be connected to many buyers without being strongly dependent on any one of them; another supplier can depend heavily on a single buyer even when the monetary flow is modest. Global value-chain research illustrates how coordination forms can differ with transaction complexity, codifiability, supplier capability, and power asymmetry (Gereffi et al. 2005). GRE generalizes the analytical question beyond value chains by asking which alternatives remain feasible and how the relation changes those alternatives over time.

Dependence can be mutual and still asymmetric. Two organizations can need one another while differing substantially in their capacity to absorb interruption, replace the relationship, finance delay, or influence governing rules. Dependence can also be generated endogenously. Investment in relation-specific assets, learned routines, proprietary standards, accumulated debt, data lock-in, or care obligations can deepen reliance through continued participation.

The normative significance of dependency cannot be read directly from its magnitude. Some durable dependencies support care, specialization, infrastructure, or collective capacity. Others can expose participants to domination, extraction, or severe exit costs. GRE therefore treats dependency as an empirical relational property whose desirability requires additional normative and institutional analysis.

12.6.11 Cooperation

Cooperation relations coordinate contributions toward purposes that are shared, mutually compatible, or jointly produced to some degree. Cooperation can occur within firms, households, research groups, cooperatives, supply networks, professional communities, public institutions, commons, and informal associations. It can be supported by contracts, reciprocity, norms, trust, authority, repeated interaction, shared infrastructure, or combinations of these mechanisms.

Economic organization cannot be reduced to a choice between anonymous markets and centralized hierarchy. Powell's analysis of network forms emphasizes reciprocal communication and exchange as a distinctive organizational mode (Powell 1990), while empirical work on biotechnology shows that interorganizational collaboration can become an important locus of learning and innovation (Powell et al. 1996). Commons research likewise documents institutional arrangements through which participants can organize collective action outside a simple market-versus-state dichotomy (Ostrom 1990; Ostrom 2010).

GRE examines cooperation through contribution, coordination, learning, surplus generation, distribution, membership, and exit. Cooperation can create capacities

that no participant possesses independently, including shared knowledge, standards, infrastructure, reputation, or political and bargaining capacity. It can also conceal unequal burdens or distribute benefits unevenly. The existence of joint production therefore does not settle questions of fairness, voluntariness, or governance.

Cooperation is also dynamic. Successful interaction can deepen trust and specialization, while repeated imbalance can generate resentment, dependence, or conflict. Institutional design can stabilize some cooperative patterns while displacing others. The relation-form is therefore best understood through its history and its connections to authority, trust, dependency, and higher-order collective relations.

12.6.12 Conflict

Conflict relations arise where subjects or entities contest resources, rules, obligations, recognition, control, distributions, classifications, or future trajectories. Conflict can occur within cooperation as well as between competitors. It can be explicit through bargaining, litigation, strikes, political contestation, or organizational disputes, and it can remain latent where disagreement is constrained by authority, dependency, or the anticipated cost of expression.

Economic conflict has analytical value because it can reveal relational structures that routine coordination leaves obscure. Bargaining disputes can expose dependence on specialized labor or infrastructure; conflicts over ownership can reveal competing claims to use and control; disputes over classification can alter eligibility, remuneration, or regulatory treatment; conflicts over standards can shape market access and technological trajectories. Simmel's relational sociology treated conflict as one form of interaction rather than as evidence that social relation has disappeared (Simmel 1971). GRE adopts the narrower implication that conflict can itself reorganize economic relations.

Conflict can generate institutional change, renegotiated terms, separation, new coalitions, or further concentration of power. It can also destroy productive capacity, trust, infrastructure, or possibilities for later cooperation. The relevant analysis should therefore identify the object of contestation, the parties and their alternatives, the institutional arena, the distribution of power, the temporal dynamics of escalation or settlement, and the consequences for later relational configurations.

The relation-forms developed throughout Section 12.6 remain analytical projections of more complex configurations. Exchange can contain authority; labor can contain care; ownership can condition credit; knowledge can generate dependency; trust can support cooperation; conflict can transform institutions. GRE therefore proceeds from pairwise or named relation-forms toward relations among relations. Section 317 develops higher-order economic relations, including triadic, multilateral, collective, and institutionalized structures in which economic consequences arise from configurations that cannot be reconstructed adequately from isolated dyads alone.

12.7 Higher-Order Economic Relations

Section 12.6 introduced selected economic relation-forms as analytical vocabularies for exchange, production, labor, ownership, credit, care, knowledge, trust, authority, dependency, cooperation, and conflict. The present section examines configurations in which economically consequential structure cannot be reconstructed adequately from isolated pairwise relations alone. Its role is to extend the relational architecture from named dyads toward triadic, multilateral, collective, hyperrelational, and institutionalized arrangements, including relations among relations and collectively distributed obligations and capacities. The objective is conceptual rather than classificatory closure: to identify recurrent forms of higher-order economic organization while preserving the possibility that other forms become relevant in different historical and empirical settings. The discussion combines relational reconstruction with selected higher-order network and institutional perspectives, while treating formal hypergraph or simplicial representations as optional analytical tools rather than ontological commitments.

Pairwise representation remains useful for many economic questions. A wage relation, credit contract, ownership claim, or exchange can often be analyzed initially through relations between identifiable parties. Yet economic consequences frequently depend on a wider configuration. A platform transaction can involve a user, provider, platform operator, payment infrastructure, ranking system, and regulatory environment. A loan can depend on a borrower–lender relation whose feasible terms are jointly conditioned by collateral ownership, guarantors, rating practices, and legal priority. A commons arrangement can distribute rights and obligations through rules applying to a group whose operation cannot be inferred from separate bilateral promises. Work on higher-order networks similarly emphasizes that interactions among groups can carry structural and dynamical information that ordinary pairwise graphs do not preserve (Battiston et al. 2020; Bick et al. 2023). GRE uses that insight selectively: higher-order representation is warranted when the configuration itself contributes explanatory content.

Definition 12.22 (Higher-order economic relation). Within GRE, a *higher-order economic relation* is a historically situated relational configuration in which the economically relevant capacities, constraints, obligations, expectations, or transformations depend materially on a combination of participants, roles, rules, or lower-order relations that cannot be represented adequately, for the inquiry at hand, as independent pairwise connections. Higher-order attribution is therefore problem-relative and should identify the explanatory loss produced by pairwise decomposition.

Definition 12.22 makes higher-order status an analytical claim rather than a synonym for numerical multiplicity. Three actors can participate in a structure that is fully reconstructed by three dyadic relations; conversely, two named organizations can stand within a relation whose content depends on internal roles, external rules, and institutional linkages that make a simple dyad inadequate. The relevant question is therefore whether decomposition preserves the mechanism under study.

Table 12.9 summarizes the principal forms developed in this section. The categories overlap. A multilateral relation can become institutionalized; a collective relation can carry collective obligations; a hyperrelation can be one representation of

Table 12.9: Selected forms of higher-order economic relations and their analytical roles.

Form	Analytical role	Selected questions
Triadic relation	Captures a third position that conditions a relation between two others	Mediation, brokerage, guarantee, adjudication, platform intermediation, third-party dependence
Multilateral relation	Represents coordinated or mutually conditioning relations among several participants	Joint terms, rule dependence, contribution, coalition, compatibility, shared exposure
Collective relation	Treats participation in a collectivity as economically consequential	Membership, representation, contribution, collective decision, distribution, exit
Hyperrelation	Represents one relation connecting several units or roles simultaneously	Group interaction, joint production, irreducibility, representation choice, evidential support
Relations among relations	Examines how one relation conditions, transforms, or governs another	Ownership–labor, credit–collateral, authority–knowledge, regulation–market, dependency–exit
Institutionalized relation	Stabilizes positions and interaction through rules, offices, procedures, or recognized categories	Role structure, rule scope, enforcement, succession, contestability, historical change
Collective obligation	Distributes an obligation across a group, office, institution, or coordinated structure	Attribution, contribution, discharge, residual responsibility, internal allocation
Collective capacity	Arises from coordinated relations that enable action unavailable to isolated participants	Complementarity, coordination, infrastructure, learning, resilience, access, governance

a relation among relations; and collective capacity can emerge from several of these structures at once.

Proposition 12.23 (Configuration-sensitive explanation). *Where an economic outcome depends materially on the joint arrangement of several relations, roles, or participants, pairwise decomposition can preserve local connections while losing configuration-sensitive mechanisms. A higher-order representation can be analytically preferable when it makes the relevant joint structure explicit and remains empirically interpretable.*

Proposition 12.23 does not establish a general superiority of higher-order models. Additional structure increases representational demands and can create new identification, measurement, and interpretation problems. The remainder of the section

therefore develops higher-order forms together with their scope conditions.

12.7.1 Triadic Relations

Triadic relations arise when a third position materially changes the economic relation between two other positions. The third position can mediate, guarantee, authorize, certify, rank, finance, adjudicate, monitor, or otherwise condition interaction. Examples include buyer–seller–platform structures, borrower–lender–guarantor arrangements, worker–employer–regulator configurations, principal–agent–auditor relations, and producer–distributor–consumer chains. The analytical relevance of the third position depends on mechanism rather than headcount.

A triadic structure can generate possibilities that do not exist in the corresponding dyads considered separately. A guarantor can expand feasible credit; an auditor can alter the informational conditions of contracting; a platform can create matching capacity while also controlling visibility and access; a regulator can change bargaining or compliance conditions between firms and workers. The third position can therefore modify the terms, credibility, enforceability, or feasibility of another relation.

Triads also permit indirect dependence and brokerage. One party may become dependent on another through a third party that controls access, information, or authorization. A producer can appear to transact directly with consumers while practical access depends on a platform’s ranking and payment infrastructure. Conversely, an intermediary can reduce dependence by creating alternatives, standardizing information, or supplying guarantees. The same structural location can thus support different economic consequences under different institutional conditions.

Triadic analysis should also preserve role asymmetry. Three positions need not possess equivalent agency, responsibility, or capacity. One position may be an institutional office, algorithmic system, legal category, or infrastructure rather than a person or organization. GRE therefore specifies the relevant role of each position and asks which relation changes when the third position changes. Triadic description earns its analytical role when it identifies a mechanism that a set of disconnected dyadic descriptions would obscure.

12.7.2 Multilateral Relations

Multilateral relations involve several participants whose terms of participation are jointly conditioned. They appear in partnerships, consortia, standards bodies, supply arrangements, payment systems, insurance pools, multistakeholder governance, joint ventures, cooperatives, and many forms of collective production. A multilateral relation differs from a collection of bilateral contracts when participation by one party changes the feasible or meaningful terms available to others.

Compatibility is one source of multilateral structure. Technical standards, shared infrastructures, currencies, protocols, and platform rules can make the value or feasibility of one participant’s action depend on adoption by many others. Network-effect analysis provides one familiar economic example in which system-level adoption affects the value of compatible goods and services (Katz and Shapiro 1994). The relevant higher-order mechanism can nevertheless involve more than positive network

effects: congestion, exclusion, systemic exposure, coordination costs, or standard-setting power can also emerge through multilateral dependence.

Contribution structures provide another source. Joint production can require complementary inputs that have limited value in isolation. Research consortia, infrastructure projects, cooperative enterprises, and complex supply systems can depend on differentiated contributions whose timing and compatibility matter jointly. Bilateral accounting of each contribution may remain useful, yet it can fail to represent the collective production condition that links them.

Multilateral relations can also generate coalition and veto structures. Some decisions require unanimity, qualified majorities, representative procedures, delegated offices, or compatibility across several organizations. The economic effect therefore depends partly on decision rules. GRE treats those rules as part of the relational configuration when they shape contribution, access, distribution, or feasible change. Later sections on organizations, institutions, markets, and infrastructure develop these arrangements at greater depth.

12.7.3 Collective Relations

Collective relations arise when participation in a group, organization, community, association, commons, or other collectivity becomes economically consequential in its own right. The collectivity can coordinate resources, represent members, establish rules, maintain infrastructure, allocate benefits, negotiate externally, or preserve shared knowledge. Collective relation therefore concerns more than simultaneous participation by many individuals; it concerns a structure through which membership and joint organization affect capacities and obligations.

The relation between persons and groups can itself be analytically dual. Breiger's analysis of persons and groups shows how membership structures connect interpersonal and intergroup patterns (Breiger 1974). For GRE, this helps clarify why collectivity can be approached through several linked levels: subjects relate to a collective, the collective relates externally to other entities, and those external relations can feed back into the positions of members. A labor union, cooperative, professional association, household, or research consortium can therefore alter an individual's bargaining, learning, risk exposure, or access by mediating relations that no member controls independently.

Collective relations also raise questions of representation. An organization may speak or contract in the name of members without reproducing every member's preference. Internal decision procedures, delegation, voting rights, expertise, informal authority, and unequal participation shape what becomes the collective position. Treating the collective as a single actor can be useful for some questions while concealing internal relational heterogeneity for others.

Collective relation should therefore be specified with a scale and purpose. A cooperative can be treated as one entity in a market transaction and decomposed into members, offices, contribution rules, and internal conflicts when studying distribution or governance. This scale dependence follows the treatment of entityhood in Section 12.5 and prepares the later analysis of organizations, communities, commons, and institutions.

12.7.4 Hyperrelations

The term *hyperrelation* is useful when one relational object connects several participants or positions simultaneously and the joint connection is analytically meaningful. In a mathematical representation, a hyperedge can connect an arbitrary number of nodes, while simplicial or related higher-order structures can encode additional patterns of group interaction. Reviews of higher-order network methods emphasize that these representations can capture structures and dynamics unavailable to ordinary pairwise graphs (Battiston et al. 2020; Bick et al. 2023).

GRE uses hyperrelational language with ontological restraint. A group interaction need not literally be a hyperedge in the world. Hypergraph, simplicial, factor-graph, event-complex, tensor, or other representations can be selected according to the inferential task and available evidence. The analytical burden is to explain what information the higher-order object preserves and what would be lost under pairwise decomposition.

Several economic examples motivate the representation. A production task can require three complementary capabilities simultaneously; a contract can bind several parties under one joint condition; a committee decision can depend on a quorum; a platform transaction can require compatibility among user, provider, platform, and payment infrastructure; a commons rule can apply collectively to a defined participant set. In each case, the economically relevant condition may attach to the group configuration rather than to independent pairwise links.

Higher-order formalization also introduces risks. Group membership may be incompletely observed, interaction boundaries may be ambiguous, and apparent higher-order effects can sometimes be represented through latent variables or omitted mediators. Formal complexity can exceed evidential support. GRE therefore treats hyperrelations as an optional representation whose adequacy should be justified through the research question, mechanism, evidence architecture, and comparison with simpler alternatives.

Caution 12.24 (Higher-order representation and evidential burden). A higher-order representation should not be inferred solely from the presence of several participants. The analysis should identify the joint mechanism being represented, the evidence supporting the relevant group or relational boundary, and the inferential advantage over an adequate pairwise or latent-variable account.

12.7.5 Relations among Relations

Higher-order economic structure can arise when one relation conditions the formation, meaning, or effect of another relation. This is a relation-among-relations problem. Ownership can condition labor authority; credit can depend on collateral ownership; legal status can condition market access; trust can alter monitoring requirements; dependency can change bargaining within exchange; knowledge asymmetry can strengthen authority; care obligations can shape labor participation. The relevant analytical object is the patterned interaction among relation-forms.

Relations among relations can be reinforcing. Ownership plus financing control can deepen authority over production; accumulated trust plus repeated cooperation

can reduce coordination costs; shared knowledge plus common infrastructure can expand collective learning. They can also counteract one another. Regulatory authority can constrain ownership power; collective organization can reduce asymmetric dependency; transparent information can weaken gatekeeping based on knowledge asymmetry.

Temporal order matters. A relation formed earlier can change the conditions under which a later relation becomes possible. Debt can precede and condition labor choices; previous collaboration can create trust that enables subsequent joint investment; legal recognition can transform an informal claim into an enforceable ownership relation. Conversely, a later institutional change can reinterpret earlier obligations. Higher-order analysis therefore joins relational composition to event history rather than treating the configuration as timeless.

This perspective also qualifies causal attribution. Observed outcomes may be associated with one visible relation while depending on a bundle of interacting relations. For example, a nominal price difference can reflect market concentration, financing conditions, platform access, standards, regulation, and informational asymmetry. GRE does not require that every analysis reconstruct the entire relational field. It does require that the selected explanatory relation be treated as a scoped abstraction whose omitted relational conditions remain open to investigation when they materially affect inference.

12.7.6 Institutionalized Higher-Order Relations

Higher-order relations become institutionalized when rules, roles, procedures, recognized categories, offices, or recurrent practices stabilize how several positions relate. An institution can specify who may participate, which actions are permitted, how contributions are evaluated, how disputes are resolved, and how authority or resources move across positions. Institutionalization can therefore condense a complex relational pattern into durable expectations without eliminating its internal plurality.

Institutional analysis provides several precedents for studying such structured interaction. North emphasizes institutions as constraints shaping interaction (North 1990), while Ostrom develops rule-centered frameworks for analyzing diverse action situations and polycentric arrangements (Ostrom 2005; Ostrom 2010). GRE draws on these traditions while emphasizing the historical evolution of the relations that rules stabilize and the possibility that formal rules, enacted practices, and experienced positions diverge.

Institutionalized higher-order relations often involve roles whose meaning depends on one another. Employer and employee roles, creditor and debtor positions, regulator and regulated entity, owner and beneficiary, member and representative, or platform operator and participant acquire practical content through complementary rule structures. The institution can persist despite turnover in the persons occupying those roles. Its economic reality therefore depends partly on stabilized relations among positions rather than continuity of particular individuals.

Institutionalization can reduce uncertainty, enable coordination, and preserve collective memory. It can also make asymmetries durable, create entry barriers, stabilize obsolete practices, or detach formal authority from the conditions that originally

justified it. These possibilities are empirical and normative questions rather than implications of institutional persistence itself. A later section develops institutions as relational infrastructure in greater detail; the present subsection establishes their higher-order relational basis.

12.7.7 Collective Obligations

Collective obligations arise when responsibility for contribution, maintenance, repayment, care, compliance, risk bearing, restitution, or another required performance is distributed across a collective structure. The obligation may attach to an organization as a recognized entity, to offices within it, to members under a contribution rule, or to several parties jointly. The economic significance lies in how the relational architecture allocates responsibility and in what occurs when internal allocation and external attribution diverge.

An organization's obligation to pay wages, maintain infrastructure, repay debt, satisfy safety standards, or honor a collective agreement can survive turnover among individual members or managers. Internal procedures may allocate tasks for discharging the obligation, while external law or contract recognizes the organization as the relevant obligor. Collective obligation therefore illustrates the difference between entity-level attribution and the relational processes through which performance actually occurs.

Distribution within the collective can be unequal. Some participants may possess authority to commit the group while others bear much of the practical cost. Contribution rules can allocate obligations by membership, use, benefit, capacity, role, or negotiated agreement. Commons governance research documents how rules concerning participation, monitoring, contribution, and sanction can support collective resource arrangements under some conditions (Ostrom 1990). GRE treats such arrangements as historically situated examples rather than a universal model for collective obligation.

Collective obligations can also leave residual relations after formal dissolution or exit. Debt, pension commitments, environmental remediation, data stewardship, contractual warranties, or care responsibilities may persist when an organization restructures or ceases ordinary activity. Analysis should therefore distinguish termination of the collective's coordinating structure from discharge of obligations generated during its history. This point connects higher-order relations to the residual histories discussed for entity dissolution in Section 12.5.

Remark 12.25 (Attribution and internal distribution). Collective attribution does not by itself determine how an obligation should be distributed internally. Entity-level responsibility, role-specific duties, causal contribution, benefit, capacity, legal liability, and negotiated burden sharing can point to different internal allocations. Their relevance depends on the institutional and normative framework governing the case.

12.7.8 Collective Capacities

Collective capacities are capabilities generated or made accessible through coordinated relations among several subjects, entities, roles, or infrastructures. They in-

clude capacities for production, bargaining, learning, risk pooling, standard setting, financing, research, representation, maintenance, care, emergency response, and governance. Their defining feature is configuration dependence: the capacity cannot be assigned straightforwardly to any isolated participant without reference to the relational arrangement that enables it.

Collective capacity can arise through complementarity. A research collaboration can combine distinct expertise and equipment; a supply system can coordinate specialized production stages; an insurance pool can distribute exposure; a cooperative can aggregate bargaining or purchasing power; shared infrastructure can allow participants to perform activities that would be prohibitively costly individually. Interorganizational network research provides empirical examples in which collaboration becomes a locus of learning and innovation (Powell et al. 1996). Such cases illustrate how relational organization can generate capacities beyond the pre-existing capabilities of participants.

Collective capacity is not necessarily harmonious or equally shared. A platform ecosystem can create substantial matching and coordination capacity while concentrating rule-setting power. A supply network can achieve productive specialization while producing asymmetric dependence. A financial system can pool liquidity while generating correlated exposure. Capacity at one scale can therefore coexist with vulnerability, exclusion, or reduced autonomy at another. GRE treats the distribution, accessibility, and control of collective capacity as separate analytical questions.

Capacity can also decay. Loss of trust, key participants, shared infrastructure, institutional legitimacy, financing, or tacit coordination knowledge can weaken collective performance even where formal membership persists. Conversely, repeated coordination can generate routines, standards, common knowledge, and institutional memory that make later collective action easier. Collective capacity is therefore historical rather than a static sum of individual resources.

Proposition 12.26 (Relational generation of collective capacity). *A collective capacity can be attributed to a relational configuration when its exercise depends materially on coordinated complementarities, rules, infrastructures, or shared histories that are unavailable to the relevant participants acting separately. The attribution should remain scale-specific and should distinguish collective capacity from its distribution, control, accessibility, and normative evaluation.*

The proposition on collective capacity closes the movement from pairwise relations to configuration-dependent economic possibilities. Higher-order relations can generate obligations, capacities, dependencies, and institutional positions that alter what economic subjects can do and what futures remain available to them. The forms developed here remain a provisional analytical repertoire rather than a completed taxonomy. Section 318 therefore shifts from individual higher-order forms to *relational configurations*: patterned combinations of subjects, entities, relations, boundaries, and histories that can be studied as economic architectures at different scales.

12.8 Relational Configurations

Economic analysis often requires more than identification of subjects, entities, or relation-forms. It also requires an account of how several relations are arranged together, which positions they make available, how local and wider structures constrain one another, and which patterns remain sufficiently coherent to influence later economic possibilities. This section develops *relational configuration* as an intermediate analytical object between individual relations and the larger organizations, institutions, markets, infrastructures, and fields examined later in the chapter. Its objective is to distinguish recurrent configuration forms without treating them as a complete taxonomy or as fixed ontological layers. The discussion proceeds from dyadic and neighborhood configurations through local, organizational, institutional, field, nested, and overlapping forms, and then considers configuration stability and transformation. The method is relational and historical: configuration boundaries, relevant components, and explanatory scale are selected in relation to the question under study and remain open to revision when the evidence or practical problem changes.

A configuration is therefore more than a list of connections. Two empirical settings can contain similar relation-types while differing substantially in the arrangement of those relations, the positions they create, and the possibilities available to participants. Ownership, credit, authority, trust, labor, and knowledge relations can combine so that control is dispersed in one setting and concentrated in another. Comparable exchange links can be embedded in different institutional, infrastructural, or reputational environments and thereby produce different access, bargaining, or learning conditions. Network and embeddedness traditions have long emphasized that economic action can depend on patterns of social connection and institutional context rather than on isolated transactions alone (Granovetter 1985; Wellman 1983). GRE uses this insight while keeping the unit of configuration problem-relative and historically revisable.

Definition 12.27 (Relational configuration). Within GRE, a *relational configuration* is a selected arrangement of economic subjects, entities, relations, higher-order relations, positions, rules, and relevant contextual conditions whose organization contributes explanatory content for the inquiry at hand. Configuration attribution requires an explicit analytical boundary or resolution and may be revised when another arrangement better accounts for observed capacities, constraints, dependencies, transformations, or histories.

Definition 12.27 makes configuration an analytical reconstruction rather than a claim that the economic world is naturally partitioned into fixed relational wholes. The same participant can belong to several configurations at once; the same relation can be locally important and systemically peripheral; and a configuration that is useful for one question can obscure mechanisms relevant to another. Configuration analysis therefore asks what arrangement is being selected, which relations and conditions are included, why that resolution is useful, and what explanatory consequences follow from the selection.

Table 12.10 summarizes the principal configuration forms developed in this section. The categories overlap and can be combined. An organizational configuration

Table 12.10: Selected relational configuration forms and their analytical roles.

Configuration form	Analytical focus	Illustrative questions
Dyadic	Arrangement of several relation-forms between two positions	Which relations coexist, reinforce, offset, or transform one another?
Relational neighborhood	Relations surrounding a focal subject, entity, or position	Which nearby ties provide access, information, obligation, exposure, or alternatives?
Local	Bounded pattern of positions and relations relevant to a local process	Which local mechanisms generate coordination, exclusion, dependence, or learning?
Organizational	Internal and boundary-crossing arrangement of roles, authority, resources, knowledge, and obligations	How does organizational architecture distribute capacity, control, responsibility, and dependence?
Institutional	Pattern stabilized through rules, categories, offices, procedures, expectations, and enforcement	Which relations are reproduced, authorized, constrained, or made legible?
Field	Wider distribution of positions, resources, relations, and interaction possibilities around a domain of activity	Which positions, dependencies, and pathways shape participation without requiring direct connection among all actors?
Nested	Configurations embedded within or conditioned by configurations at other scales	Which cross-scale relations preserve, amplify, or transform local structure?
Overlapping	Configurations sharing subjects, entities, relations, resources, or rules	Where do multiple memberships, obligations, authorities, or classifications interact?

can contain several local neighborhoods, participate in an institutional configuration, and occupy a position within a wider field configuration. Nested and overlapping structures therefore concern relations among analytical configurations as much as additional substantive categories.

Proposition 12.28 (Configuration-sensitive causal relevance). *Where economic capacities, constraints, or transitions depend materially on the arrangement of several relations or positions, explanation can require the configuration as an analytical object in addition to its component relations. The relevance of the configuration should be established through the mechanism, evidence, or counterfactual contrast appropriate to the inquiry rather than inferred from structural complexity alone.*

Proposition 12.28 preserves a demanding evidential standard. A complex diagram does not establish a configuration-level mechanism. Configuration analysis earns its

role when arrangement affects what can happen: who can reach a resource, who can substitute for whom, which information travels, whose authorization is required, where obligations accumulate, which shocks propagate, or how later relations can form.

12.8.1 Dyadic Configurations

A dyadic configuration concerns the patterned set of economic relations connecting two analytical positions. Section 12.6 distinguished relation-forms such as exchange, labor, ownership, credit, trust, authority, dependency, cooperation, and conflict. In practice, two positions can participate in several of these forms simultaneously. The dyadic configuration records that composition and examines how the relations condition one another.

An employment relation illustrates the point. Worker and employer can be connected through wage exchange, productive cooperation, authority, knowledge dependence, trust, legal obligation, and possible conflict. A creditor and borrower can be connected through credit, collateral-linked ownership claims, information disclosure, monitoring authority, and dependency. A care relation can include material transfer, obligation, trust, labor, and asymmetric exit costs. Treating each relation separately remains useful for some questions, yet the joint configuration can explain why a change in one relation modifies another.

Dyadic configuration analysis can therefore distinguish relation bundles from isolated relation labels. It asks which relations are active, which are latent, which have institutional priority, and which change the feasible alternatives of the two positions. The same nominal contract can generate different economic consequences when accompanied by different knowledge, dependency, trust, or authority relations.

This perspective also prevents overreading dyads as self-contained. Two-party configurations are usually situated within wider legal, organizational, infrastructural, and social conditions. A worker–employer configuration depends on labor law, occupational norms, labor-market alternatives, household conditions, and technological organization; a borrower–lender configuration can depend on payment infrastructures, bankruptcy rules, collateral registries, and monetary institutions. Dyadic analysis therefore offers a local analytical resolution whose boundary should remain explicit.

12.8.2 Relational Neighborhoods

A relational neighborhood is the selected set of economically relevant relations surrounding a focal subject, entity, or position. The concept shifts attention from one tie to the immediate relational environment through which a participant obtains information, resources, authorization, support, obligations, exposure, and alternatives. Its boundary can be defined by direct relation, short relational distance, shared institution, functional dependence, or another criterion suited to the inquiry.

Relational neighborhoods matter because local opportunity and constraint can depend on the composition of nearby relations. Two firms with similar internal capabilities can face different possibilities when one has diverse suppliers, financiers,

knowledge partners, and distribution channels while another depends on a narrow set of counterparties. Two households with similar income can differ in practical resilience because kinship support, care obligations, credit access, transport, housing, or public-service relations differ. Neighborhood composition can therefore mediate the conversion of nominal resources into effective capacities.

Neighborhood analysis also makes alternatives visible. Dependency often depends less on the presence of one important relation than on the absence of credible substitutes. A focal actor embedded in several partially substitutable relations can possess greater room for revision or exit than one whose neighborhood is highly concentrated. Conversely, dense local relations can generate coordination and trust while also increasing exposure to correlated disruption, reputational closure, or locally enforced norms.

The relevant neighborhood is problem-specific. Geographic proximity can matter for some labor, care, infrastructure, or retail questions, while informational, contractual, technological, or institutional proximity can matter more elsewhere. GRE therefore treats neighborhood as a relational resolution rather than a fixed spatial radius.

12.8.3 Local Configurations

Local configurations extend neighborhood analysis to a bounded pattern containing several positions and relations that jointly sustain a process. A local configuration can be spatial, organizational, technological, institutional, or functional. Examples include a workplace team, a production cluster, a local credit ecology, a care network, a procurement arrangement, a research collaboration, or a neighborhood service system. The term *local* therefore refers to analytical scale rather than necessarily to physical distance.

The economic importance of a local configuration can arise from repeated interaction, complementarity, coordination costs, common infrastructure, shared rules, tacit knowledge, or locally available alternatives. Such configurations can generate capacities that are difficult to attribute to one participant. They can also generate exclusion where access depends on membership, reputation, credentialing, interoperability, or proximity to a local hub.

Local configurations are particularly useful for studying heterogeneity within larger systems. An industry described at national scale can contain local configurations with different labor practices, financing arrangements, technological standards, or trust structures. A large organization can contain teams or divisions with distinct knowledge flows and authority patterns. Aggregate indicators can therefore conceal local arrangements that matter for intervention or explanation.

Locality remains relative to the selected process. A configuration that is local from the perspective of a global supply system can be expansive from the perspective of a worker or household. GRE consequently records the focal process, boundary, and comparison scale rather than treating *local* as an intrinsic property.

12.8.4 Organizational Configurations

Organizational configurations concern patterned relations among roles, units, resources, rules, information channels, authority positions, and external interfaces within an organized economic entity or coordinated collective. The concept provides a configuration-level view of organizations while leaving detailed analysis of organizational boundaries, membership, and stabilization to later sections of the chapter.

An organizational chart can record formal reporting lines while leaving many economically consequential relations implicit. Expertise can be concentrated outside formal authority; budget control can sit apart from operational responsibility; informal trust networks can accelerate or obstruct coordination; external contractors can perform central functions without formal membership; digital systems can mediate access and visibility across units. Organizational configuration therefore includes both formal and practically operative relations where the inquiry requires them.

Several organizational properties can be configuration-sensitive. Redundancy can depend on whether comparable capacities exist in more than one unit. Bottlenecks can arise where many processes depend on one role, database, authorization channel, or infrastructure. Learning can depend on cross-unit ties rather than on aggregate expertise. Responsibility can become diffuse when authority, information, and implementation are distributed across different positions. These patterns can remain invisible if an organization is treated as a unitary actor.

GRE does not infer organizational quality from any one configuration. Centralization can accelerate some decisions and intensify some dependencies; decentralization can preserve local knowledge and also fragment coordination. Dense internal relations can support learning and create conformity. The analytical task is to reconstruct how a given arrangement generates capacities, constraints, exposures, and possible transformations under specified conditions.

12.8.5 Institutional Configurations

Institutional configurations arise where rules, categories, offices, procedures, expectations, and enforcement arrangements stabilize patterned economic relations across repeated situations. Institutional analysis therefore adds more than the existence of a rule. It asks how several rules and roles combine, which positions they create, what behavior becomes recognized or excluded, and how institutional components condition one another.

Institutional configurations can include legal classifications, licensing arrangements, accounting standards, eligibility rules, professional norms, enforcement procedures, dispute-resolution mechanisms, and recognized offices. Their economic significance often emerges through composition. A property right depends on rules of recognition, transfer, exclusion, registration, enforcement, and remedy; a credit system depends on contractual, monetary, accounting, informational, and insolvency arrangements; labor-market participation can depend on employment classification, immigration status, credential recognition, tax treatment, and social-insurance rules.

Institutional configurations also shape legibility. Categories determine which sub-

jects, entities, assets, transactions, and obligations become administratively visible. That legibility can enable coordination, protection, taxation, comparison, or enforcement while also compressing heterogeneous relations into standardized forms. Later analysis of symbolized economic relations will examine representation in greater depth; the present concern is the configuration through which multiple institutional representations and rules jointly structure participation.

Institutional configurations are historical and contestable. Rules can persist while their interpretation changes; offices can retain names while their practical authority shifts; informal practices can alter how formal procedures operate. Institutional stability therefore requires attention to implementation, recognition, and relational reproduction in addition to written rules.

12.8.6 Field Configurations

Field configurations describe wider distributions of positions, relations, resources, capacities, rules, expectations, and pathways around a domain of economic activity. A field representation can be useful where actors affect one another through shared institutions, competition, standards, reputation, prices, infrastructures, or positional relations even when direct ties are incomplete. Sociological field approaches similarly emphasize structured positions and interaction arenas rather than reducing collective outcomes to isolated actors (Bourdieu and Wacquant 1992; Fligstein and McAdam 2012).

Within GRE, field language remains an analytical option under ontological restraint. A field configuration can represent gradients of access, concentration of knowledge, distribution of bargaining alternatives, technological compatibility, reputational standing, regulatory exposure, or other positional conditions. The representation should specify which variable or relation gives the field interpretation empirical meaning. Invoking a field metaphor without such specification adds little explanatory value.

Field configurations can capture indirect conditioning. A firm can face altered financing conditions because of a sector-wide shift in risk perception without direct interaction with every relevant investor. A worker's bargaining position can change because of regional labor demand, credential structures, or platform rules. A household's housing possibilities can change through interest rates, land-use regulation, and neighborhood demand. These effects can be relational even when they are mediated through aggregate or institutional mechanisms.

Field boundaries remain contestable. Economic domains overlap, and the actors that shape a field need not coincide with those formally classified inside it. Regulators, infrastructures, financial institutions, standards bodies, communities, and technological providers can influence a production or market field from positions that appear external under a narrower classification. Field analysis therefore requires explicit boundary reasoning and sensitivity to cross-field coupling.

12.8.7 Nested Configurations

Nested configurations arise when one relational configuration is embedded within, governed by, dependent on, or otherwise conditioned by another configuration at a different analytical scale. Households can be situated within neighborhoods and welfare institutions; teams within firms; firms within supply systems and regulatory regimes; local credit relations within national monetary and legal architectures. Nesting can therefore connect micro-, meso-, and macro-level descriptions without assuming that these levels form a single rigid hierarchy.

Nesting matters when processes at one scale change the feasible relations at another. A national legal rule can alter household or organizational contracts; organizational restructuring can change local labor and care relations; local innovations can diffuse into sectoral standards; a transnational infrastructure can constrain domestic institutional options. Cross-scale influence can move in several directions and can be asymmetric.

Analytical nesting should distinguish containment from dependence. A configuration can be geographically inside another while remaining weakly dependent on it, and a configuration can be strongly conditioned by a distant system without spatial containment. Technical platforms, payment systems, cloud infrastructures, standards, and global supply arrangements illustrate forms of functional nesting that cannot be represented adequately by geography alone.

Nested analysis also raises aggregation problems. Properties of a higher-level configuration cannot always be inferred by summing lower-level properties, while higher-level regularities do not determine each local history. GRE therefore treats cross-scale explanation as a problem of coupling, mediation, and transformation. Later sections on multiscale architecture develop this issue more systematically.

12.8.8 Overlapping Configurations

Overlapping configurations share subjects, entities, relations, resources, infrastructures, rules, or representations without being reducible to one another. A person can participate simultaneously in household, workplace, professional, credit, care, community, and platform configurations. An organization can belong to several supply systems, regulatory domains, financial networks, standards communities, and knowledge collaborations. Overlap is therefore a common condition of economic life rather than an exceptional complication.

Overlap can generate complementarity. Knowledge acquired in one configuration can support participation in another; infrastructure can serve several communities; reputational standing can transfer across domains; shared membership can facilitate coordination. It can also create conflict where obligations, classifications, schedules, or authorities compete. Household care demands can conflict with employment arrangements; professional obligations can conflict with organizational incentives; platform rules can conflict with public regulation; multiple creditors can assert incompatible priorities.

Overlapping configurations are especially important for responsibility and intervention. An action targeted at one configuration can propagate through shared par-

ticipants or resources into others. Closing a workplace affects households and local services; changing a platform's ranking rules can alter producer, advertising, labor, and consumer configurations; infrastructure investment can reconfigure property, transport, employment, and ecological relations simultaneously. The relevant impact boundary can therefore exceed the administrative boundary of the intervention.

Overlap also complicates identity and membership. A subject can hold different roles and rights in different configurations, and a relation can be interpreted differently across institutional settings. GRE therefore avoids assigning one total relational position to a participant where several configuration-specific positions are analytically relevant.

12.8.9 Configuration Stability

Configuration stability concerns the persistence of an economically relevant pattern despite events, turnover, local variation, or environmental change. Stability does not require immobility. A configuration can remain recognizable while participants change, relations are renegotiated, resources are replaced, or routines adapt. The relevant question is which structural or functional features persist at the resolution required by the inquiry.

Several dimensions of stability can diverge. Membership can be stable while authority relations change; formal rules can be stable while informal practices shift; network connectivity can remain similar while resource flows change; productive output can persist while the distribution of risk or responsibility changes. A statement that a configuration is stable should therefore specify the dimension and time horizon involved.

Stability can arise through repeated interaction, institutional enforcement, sunk investment, complementarity, reputation, shared infrastructure, dependency, learning, or active maintenance. Some configurations persist because they continue to generate valued capacities; others persist because alternatives are costly or because power and access are unevenly distributed. Persistence therefore carries no automatic normative endorsement.

Remark 12.29 (Dimension-relative configuration stability). Configuration stability should be reported relative to selected dimensions, scales, and time horizons. Persistence of one pattern can coexist with transformation of another, and a configuration that appears stable at aggregate scale can contain substantial local reorganization.

Stability can also be produced through compensatory change. Organizations replace staff, institutions reinterpret rules, supply systems reroute flows, and households redistribute responsibilities to preserve some higher-level function. Such adaptation can maintain continuity while shifting burdens across participants. GRE therefore distinguishes stability of the configuration from stability of the conditions experienced by each subject within it.

12.8.10 Configuration Transformation

Configuration transformation occurs when the arrangement of positions, relations, rules, boundaries, or relevant contextual conditions changes sufficiently to alter the

mechanisms or possibilities being studied. Transformation can be incremental, cumulative, abrupt, deliberately induced, or generated through interactions that were not centrally designed. It can involve relation formation or dissolution, role redefinition, entry and exit, institutional change, technological substitution, resource reallocation, new representations, or changes in cross-scale coupling.

The history of transformation matters because similar endpoint diagrams can conceal different trajectories. A concentrated market position reached through merger can differ in obligations and expectations from one produced by technological standardization or network effects. A cooperative arrangement created through negotiated institution-building can differ from one produced by emergency coordination even if the later membership pattern appears similar. Event order can shape trust, legitimacy, dependency, learning, and available alternatives.

Transformation can also alter the analytical boundary itself. New infrastructures can connect previously separate configurations; institutional reforms can create new categories of membership; technological change can move functions across organizational boundaries; crisis can expose relations that ordinary accounting treated as external. Configuration analysis therefore permits the unit of analysis to change when the economic mechanism changes.

Some transformations preserve many local relations while changing their joint consequences. A new rule can alter bargaining across an existing network; a change in information architecture can modify authority without changing formal ownership; new interoperability can reduce dependency by making alternatives feasible. Configuration-level analysis is useful precisely because transformation can occur in arrangement and conditioning as well as in the presence or absence of individual ties.

Remark 12.30 (Revisable configuration attribution). A relational configuration should remain a revisable analytical commitment. When later evidence shows that the selected boundary, scale, or relation set obscures an important mechanism, GRE permits reconstruction at another resolution rather than preserving the original configuration for classificatory consistency alone.

The configuration perspective developed in this section prepares more precise analysis of economic boundaries and membership. Once a configuration has been selected, questions arise concerning who or what is included, which relations cross its boundary, how entry and exit occur, and how inclusion or exclusion changes capacities and obligations. The following analysis of boundaries and membership develops those questions directly.

12.9 Boundaries and Membership

Economic configurations become analytically usable only when some distinction is drawn between what is treated as belonging to the configuration and what is treated as outside it, adjacent to it, or connected across its boundary. Such distinctions can be legal, organizational, institutional, functional, spatial, technical, statistical, social, or analytical, and they need not coincide. This section develops boundaries and membership as historically produced and problem-relative dimensions of economic ar-

chitecture. Its objective is to clarify how economic boundaries are formed and maintained, how membership is attributed and experienced, how entry and exit alter relations and capacities, and how boundaries become contested or transformed. The discussion proceeds across economic, organizational, institutional, market, and community boundaries before examining entry and exit, inclusion and exclusion, multiple membership, contestation, and transformation. The method is relational and historical: boundaries are treated as consequential structures whose analytical relevance depends on the mechanisms and histories under study rather than as naturally given partitions of economic reality.

A boundary can stabilize coordination by identifying who may participate, which rules apply, which assets or obligations are attributed to a configuration, and where responsibility is located. The same boundary can also conceal cross-boundary dependence, redistribute exposure, or make some relations weakly visible. Organizational law, for example, can create legally consequential partitions among assets and creditor claims (Hansmann and Kraakman 2000), while economic activity within those legal partitions can remain deeply connected to suppliers, households, infrastructures, communities, regulators, and financial systems. Institutional analysis similarly emphasizes that rules structure interaction and shape the feasible conduct of participants (North 1990). GRE therefore treats boundary drawing as both an object of economic inquiry and a methodological responsibility.

Membership requires a similarly differentiated treatment. Formal membership can coexist with weak participation; non-members can exercise substantial influence; a subject can receive benefits without decision rights, bear obligations without recognition, or be exposed to consequences without having entered the configuration voluntarily. Economic inclusion is therefore not exhausted by a binary indicator of membership. The analysis should distinguish, where relevant, among formal status, participation, access, entitlement, obligation, representation, control, exposure, and practical ability to exit.

Definition 12.31 (Economic boundary). Within GRE, an *economic boundary* is a historically situated distinction that organizes the attribution of subjects, entities, relations, resources, rules, capacities, obligations, or consequences to an economic configuration for a specified institutional, practical, or analytical purpose. Boundary attribution remains revisable when cross-boundary mechanisms or changing conditions make another delineation more explanatory.

Definition 12.32 (Economic membership). Within GRE, *economic membership* denotes a specified relation of belonging, participation, recognition, entitlement, obligation, representation, or attachment to an economic configuration. Different dimensions of membership may diverge and should be distinguished when that divergence affects capacities, responsibilities, access, exposure, or feasible exit.

Definitions 12.31 and 12.32 separate boundary from membership. A boundary concerns the delineation of a configuration or domain; membership concerns how a subject or entity stands in relation to that delineation. The two interact, yet neither determines the other completely. Some boundary-crossing participants can remain economically central, while formally recognized members can occupy marginal or weakly empowered positions.

Table 12.11: Selected dimensions of economic boundaries and membership.

Dimension	Boundary or membership function	Illustrative analytical questions
Legal	Allocates recognized rights, duties, personality, title, liability, or jurisdiction	Which legal distinctions organize claims, responsibility, or asset separation?
Organizational	Differentiates internal roles and processes from external relations	Which activities, resources, and authorities are treated as internal to an organization?
Institutional	Specifies the scope of rules, categories, procedures, and enforcement	To whom do rules apply, and who can invoke, interpret, or contest them?
Market	Delimits participants, products, substitutes, venues, or interaction domains	Which exchanges and alternatives are treated as belonging to the same market process?
Community	Organizes belonging, reciprocity, stewardship, identity, or shared obligation	Which forms of participation and responsibility define practical membership?
Functional	Selects components required for a mechanism or capacity	Which formally external actors or resources are functionally necessary to the configuration?
Access and entitlement	Determines eligibility to use resources, services, infrastructures, or institutions	Which forms of membership create access, and which forms of access exist without membership?
Exposure and obligation	Extends consequences, duties, or risks across or beyond formal membership	Who bears effects or obligations despite weak recognition or decision authority?
Exit and permeability	Conditions movement across boundaries and continuation of relations after crossing	What costs, residual obligations, dependencies, or capacities shape practical exit?

Table 12.11 summarizes several boundary and membership dimensions used in this section. The dimensions are illustrative rather than exhaustive, and their relevance varies with the inquiry.

Proposition 12.33 (Boundary–membership non-equivalence). *Where legal, organizational, institutional, functional, or relational boundaries diverge, formal membership alone may provide an incomplete account of economic participation, influence, obligation, or exposure. Analysis should identify the boundary dimension relevant to the mechanism under study and distinguish it from other membership dimensions when their divergence is consequential.*

Proposition 12.33 is methodological as well as substantive. A study can obtain a clean sample by using one administrative category while still misrepresenting the mechanism if the economically relevant relations cross that administrative boundary. Conversely, expanding the analytical boundary indefinitely can destroy explanatory

resolution. Boundary selection therefore requires both inclusion discipline and exclusion discipline: the analysis should include cross-boundary relations that materially condition the process while retaining a tractable and interpretable unit of inquiry.

12.9.1 Economic Boundaries

Economic boundaries are distinctions through which activities, relations, resources, and consequences are attributed to an economic domain or configuration. They can be produced through law, accounting, organizational practice, technical architecture, statistics, geography, custom, contractual classification, or scholarly analysis. Several boundaries can coexist around the same activity, and their divergence can be economically meaningful.

A firm's accounting boundary, for example, can differ from the functional boundary of production. Purchased inputs, outsourced labor, logistics, cloud services, licensing, household care, public infrastructure, and regulatory support can remain outside the firm's formal accounts while contributing to its productive capacity. A household boundary can identify residents or kin while leaving translocal remittances, care obligations, shared assets, and informal transfers partly outside the observed unit. A national accounting boundary can classify cross-border transactions in one way while supply, ownership, knowledge, or ecological relations extend across several jurisdictions.

Economic boundaries therefore perform at least two analytical functions. First, they support attribution: output, cost, obligation, control, risk, or responsibility can be associated with a selected unit. Second, they shape visibility: relations inside the boundary are often easier to record, govern, or compare than relations that cross it. Boundary-based visibility can be useful without being complete. GRE asks which boundary generated the representation and which economically consequential relations remain outside it.

Boundaries can also influence the activity they describe. Classification into a regulated market, an employment category, a taxable entity, a household, or an eligible beneficiary group can change rights, incentives, reporting requirements, and access. Boundary making can therefore function as a performative institutional act rather than a passive description. This possibility reinforces the distinction between analytical boundary selection and claims about naturally existing economic partitions.

12.9.2 Organizational Boundaries

Organizational boundaries distinguish activities and positions treated as internal to an organization from those coordinated through external exchange, contract, partnership, regulation, or other relations. Coase's analysis of the firm made the relation between internal direction and market coordination a central economic question (Coase 1937). Subsequent institutional and organizational analysis has shown that the relevant boundary can also concern asset ownership, decision rights, contractual governance, legal personality, knowledge, and responsibility.

The organizational boundary is rarely one-dimensional. Employees can work inside an organization without owning it; contractors can participate deeply in inter-

nal processes while remaining legally external; subsidiaries can be legally separate while operationally integrated; shared-service organizations can centralize functions across formally distinct entities. Digital platforms further complicate the distinction when independent participants operate under privately specified technical rules, ranking systems, payment infrastructures, and access conditions.

Organizational law can stabilize some boundaries through legal entity formation and asset partitioning (Hansmann and Kraakman 2000). These legal boundaries matter for creditor claims, liability, control, and continuity, yet practical coordination can cross them extensively. GRE therefore distinguishes the legal boundary of the entity from the functional, informational, authority, and resource boundaries of organizational activity.

Boundary analysis also bears on responsibility. A function can be outsourced without transferring every causal dependency or social consequence associated with it. Conversely, holding an organization responsible for every external relation connected to it can erase distinctions of control and practical capacity. The relevant attribution therefore depends on the mechanism, degree of control, institutional rules, and the specific responsibility being examined.

12.9.3 Institutional Boundaries

Institutional boundaries concern the scope within which rules, categories, norms, procedures, offices, and enforcement arrangements are recognized as applicable. North's formulation of institutions as constraints structuring interaction highlights how rules can organize incentives and expectations across economic activity (North 1990). From a GRE perspective, institutional scope is also relational: the same rule can have different effects depending on who can invoke it, who is classified under it, which authorities interpret it, and which relations remain weakly covered.

Institutional boundaries can be jurisdictional, categorical, procedural, or functional. Labor protections can depend on employment classification; welfare eligibility can depend on household or income categories; financial regulation can depend on whether an activity falls within a statutory definition; professional rules can apply only to recognized members; platform governance can apply to users who accept terms without possessing meaningful authority over rule formation.

The boundary of an institution can therefore differ from the boundary of its consequences. A legal rule enacted in one jurisdiction can affect firms and households elsewhere through trade, finance, standards, or supply relations. A classification can exclude a group formally while shaping its opportunities indirectly. Institutional analysis should consequently identify both the formal domain of application and the wider relational field through which effects propagate.

Institutional boundaries can also be layered. Local, municipal, national, transnational, professional, organizational, and technical rules can apply simultaneously. Their overlap can generate complementary protections, jurisdictional gaps, conflicting obligations, or opportunities for strategic boundary use. The economic relevance of an institutional boundary often lies in these interactions as much as in the text of any single rule.

12.9.4 Market Boundaries

Market boundaries specify which participants, products, services, locations, technologies, or transactions are treated as belonging to a common domain of exchange and competition. Such boundaries are important for price comparison, competition analysis, strategy, regulation, and empirical measurement, yet they are often constructed through judgments about substitutability, participation, access, and institutional context.

A product can be a close substitute for another in one use and a poor substitute in another. Geographic distance can matter greatly for perishable goods and little for some digital services. Technical standards can divide or connect markets; transport infrastructure can enlarge effective geographic reach; regulation can create jurisdictional segmentation; platforms can create privately governed exchange environments that overlap with wider markets. Market boundaries therefore change as technologies, institutions, preferences, infrastructures, and access conditions change.

Economic sociology and substantivist traditions also caution against treating market exchange as socially detached. Economic action can remain embedded in ongoing social relations (Granovetter 1985), and Polanyi's instituted-process perspective situates exchange alongside other forms of economic integration (Polanyi 1957). These insights suggest that a market boundary can be analytically useful while remaining porous to relations of trust, authority, reciprocity, regulation, care, and community.

GRE consequently treats market delineation as a problem-relative analytical operation. The relevant question is not simply whether a market has a boundary, but which mechanisms make a particular boundary useful for the inquiry and which cross-boundary relations materially affect the observed process.

12.9.5 Community Boundaries

Community boundaries organize forms of belonging, reciprocity, stewardship, identity, obligation, shared resource use, or mutual support. Their economic significance can arise through access to common resources, informal insurance, care, knowledge, reputation, collective bargaining, mutual aid, or rules governing contribution and use. Commons research provides well-known examples in which locally organized rules and participation structures become important to collective resource governance (Ostrom 1990).

Community boundaries need not coincide with residence, kinship, citizenship, legal organization, or cultural identity. A professional community can be translocal; a neighborhood can contain several overlapping communities; an online community can organize economically consequential knowledge or support without geographic proximity; a resource community can be defined by use rights rather than identity. Membership criteria can also change through migration, technological change, institutional recognition, conflict, or generational turnover.

Community boundaries can support trust and reciprocal expectation, yet they can also generate exclusion, hierarchy, or unequal burdens. A strong internal relation can increase collective capacity while raising entry barriers for outsiders. Conversely, highly permeable boundaries can broaden access while weakening some

mechanisms of reciprocity or stewardship. GRE treats these possibilities empirically and historically rather than assuming that either closure or openness is generally preferable.

The analytical challenge is therefore to identify which form of belonging is economically relevant. Formal membership, participation in shared practices, contribution, recognition by others, access to resources, and exposure to community sanctions can diverge. Community membership is consequently another case in which a binary classification can conceal important relational differences.

12.9.6 Membership Entry and Exit

Entry and exit are processes through which membership relations are formed, altered, or terminated. Their economic significance depends on the conditions under which crossing a boundary is possible, the capacities required to do so, the obligations that accompany entry, and the residual relations that remain after exit. Entry and exit therefore provide information about boundary permeability and about the distribution of practical alternatives.

Entry can require payment, qualification, sponsorship, recognition, identity verification, ownership, contribution, location, technical compatibility, legal status, or acceptance by incumbent members. These requirements can serve legitimate functions such as safety, coordination, quality assurance, or resource stewardship, while also distributing access unevenly. The same formal entry rule can impose different practical burdens on subjects with different resources, histories, information, or institutional standing.

Exit similarly ranges from low-cost disengagement to highly constrained separation. A consumer can often switch suppliers more readily than a worker can leave a specialized labor relation, a household can relocate, or a community can abandon shared infrastructure. Contractual obligations, sunk investment, data portability, reputation, social ties, debt, legal status, geographic immobility, care responsibilities, and network dependence can all shape the practical cost of exit.

Exit also need not terminate every relation. Financial liabilities, confidentiality duties, pension rights, data traces, reputational effects, care obligations, environmental responsibilities, or claims to shared assets can persist. The event of formal exit should therefore be distinguished from the longer process through which relations are unwound, transformed, or retained.

Remark 12.34 (Practical permeability). Boundary permeability is better treated as a situated capacity than as a formal permission alone. A boundary can be legally open while remaining practically difficult to cross because the resources, information, alternatives, or institutional recognition required for entry or exit are unevenly distributed.

12.9.7 Economic Inclusion and Exclusion

Inclusion and exclusion concern the distribution of membership, access, participation, representation, entitlement, and exposure across a configuration. These dimensions can diverge. A subject can be included as a worker while excluded from gover-

nance; included as a customer while excluded from ownership; included in an administrative category while lacking effective access to the associated benefit; or excluded from formal membership while bearing substantial consequences of the configuration.

Economic inclusion should therefore be specified by object. Inclusion in a market differs from inclusion in organizational decision making; access to credit differs from participation in rule formation; legal recognition differs from practical ability to use an institution. The same distinction applies to exclusion. Exclusion from a resource, a role, a right, an information channel, or a decision process can have different mechanisms and consequences.

Some exclusion is constitutive of bounded organization. A cooperative, profession, insurance pool, public programme, or resource-governance arrangement can require eligibility criteria or defined participation rules. The analytical question is how those criteria are formed, what functions they serve, who bears their costs, and how they interact with alternative forms of access. Evaluation requires situated normative commitments and cannot be derived from the existence of a boundary alone.

Exclusion can also be indirect. Technical design, documentation requirements, scheduling, language, pricing, geography, reputation systems, or data requirements can restrict participation without an explicit exclusion rule. Relational analysis is useful here because it asks how the practical path to participation is structured, rather than inferring inclusion from nominal availability.

12.9.8 Multiple Membership

Economic subjects commonly belong to several configurations at once. A person can simultaneously be a household member, employee, borrower, shareholder, citizen, professional, platform user, community participant, caregiver, and member of several organizations. An organization can belong to supply networks, industry associations, payment systems, regulatory regimes, standards organizations, ownership groups, and research collaborations. Multiple membership is therefore a normal feature of relational economic architecture.

Multiple memberships can generate complementarity. Membership in one configuration can provide credentials, knowledge, trust, resources, or access that supports participation in another. It can also generate conflict where roles, obligations, loyalties, time demands, reporting rules, or authorities diverge. A professional duty can conflict with an organizational incentive; household care obligations can constrain employment schedules; participation in one technical ecosystem can limit compatibility with another.

Memberships can also differ in strength and form. Some are voluntary and revisable; others arise through birth, residence, legal status, dependency, contractual commitment, or infrastructural necessity. Some confer voice; others mainly impose obligations. Some can be exited individually; others remain linked to a household, organization, territory, or installed technical system. GRE therefore resists treating a subject's memberships as interchangeable affiliations.

Multiple membership complicates causal attribution and responsibility. An ob-

served action can reflect pressures and capacities generated across several configurations, and an intervention targeted at one membership can propagate through others. Analysis should identify which membership relation is active in the mechanism under study and where overlap changes the feasible response.

12.9.9 Boundary Contestation

Boundaries become contested when participants disagree about who or what belongs within a configuration, which rules apply, where responsibility ends, or which relations should be recognized as economically relevant. Such contestation can concern legal classification, organizational jurisdiction, market definition, community membership, employment status, ownership scope, professional authority, or the attribution of external costs and benefits.

Boundary contestation is economically consequential because classification can change rights, obligations, prices, liability, representation, access, and bargaining position. Disputes over whether a worker is an employee or contractor, whether a platform is a neutral intermediary or organizing authority, whether a resource is private or common, or whether an activity belongs within a regulated domain can reconfigure the relations attached to the classification.

The authority to draw a boundary is itself part of the relational structure. Legislatures, courts, regulators, organizations, professions, platforms, statistical agencies, researchers, and communities can possess different capacities to define categories and have those definitions recognized. Boundary-setting power can therefore become an object of economic analysis, especially when one actor's classification changes the feasible actions of others.

Contestation also provides epistemic information. Disputes can reveal that an inherited boundary no longer matches practical organization, that costs are being externalized, that new technologies connect previously separate domains, or that several legitimate boundary descriptions serve different purposes. GRE treats contestation as evidence that boundary attribution may require reconstruction, while preserving the possibility that some boundaries remain institutionally necessary or analytically useful.

12.9.10 Boundary Transformation

Boundary transformation occurs when the distinctions organizing membership, attribution, access, responsibility, or participation change. Transformation can follow institutional reform, organizational restructuring, technological innovation, merger, outsourcing, migration, crisis, infrastructure development, changes in standards, or gradual shifts in social recognition. It can enlarge, contract, layer, fragment, or reconnect previously separate configurations.

Boundary change can alter economic capacities even when many underlying subjects and resources remain present. A new interoperability standard can connect previously separated user groups; legal recognition can bring informal relations within a regulated domain; outsourcing can move activities across an organizational boundary while retaining technical dependence; a merger can combine assets and authority

previously held by separate entities; decentralization can distribute decision rights across several organizational units.

Transformation can also generate boundary lag. Formal classifications sometimes persist after practical relations have changed, while practical expectations can persist after legal categories have been revised. Statistical and accounting systems can continue to represent an earlier architecture. These lags matter because policy, contracts, organizational decisions, and empirical research may respond to the recorded boundary rather than to the changing relational configuration.

Remark 12.35 (Revisable boundary attribution). Boundary attribution should remain open to revision when institutional change, technological development, new evidence, or altered relational structure changes the mechanism under study. Revision should preserve provenance: the earlier boundary, the reason for changing it, and the consequences of the new delineation should remain traceable where they materially affect interpretation.

Boundaries and membership provide a vocabulary for determining which relations are treated as internal to a configuration and which cross its selected edge. That distinction prepares the analysis of internal and external economic relations, where coordination, authority, resource and knowledge flows, exchange, regulation, and mediation can be examined without assuming that formal boundaries determine the actual pathways through which economic effects travel.

12.10 Internal and External Relations

Economic analysis frequently distinguishes relations that operate within a selected configuration from relations that connect that configuration to actors, institutions, resources, and processes represented outside it. This distinction is useful for studying coordination, authority, resource and knowledge movement, exchange, regulation, mediation, and exposure, yet its meaning depends on the boundary and scale chosen for inquiry. This section develops internal and external relations as boundary-relative components of economic architecture. Its objective is to clarify how internal coordination and authority coexist with cross-boundary exchange, cooperation, regulation, and mediation, and how these relations become coupled over time. The discussion proceeds from internal coordination, authority, resource flow, knowledge flow, trust, and conflict to external exchange, cooperation and competition, regulation, mediation, and internal–external coupling. The method is relational and historical: internality and externality are treated as analytically specified positions within a selected configuration rather than as intrinsic properties of a relation.

The distinction is especially important because formal boundaries and effective economic pathways can diverge. Coase’s analysis of the firm provides a classical formulation of the contrast between coordination through the price mechanism and coordination within the firm (Coase 1937). Later institutional and organizational research has developed richer accounts of governance structures, rules, networks, and hybrid arrangements (Williamson 2000; Powell 1990). GRE uses these traditions as reference points while retaining a problem-relative account of the boundary itself. A relation classified as internal to a corporation can remain external to a division, local

unit, profession, or accounting centre; a relation external to a firm can be internal to an industry network, regulatory regime, platform ecosystem, or community. The analytical task therefore includes specifying the configuration relative to which the distinction is made.

Definition 12.36 (Internal economic relation). For a selected economic configuration C and analytical purpose q , an *internal economic relation* is a relation represented as operating among subjects, entities, roles, resources, or processes attributed to the interior of C in a way that contributes to the mechanism examined under q . Its internal status is relative to the selected boundary, scale, and purpose.

Definition 12.37 (External economic relation). For a selected economic configuration C and analytical purpose q , an *external economic relation* is a relation that crosses the selected boundary of C or connects components represented within C to subjects, entities, rules, resources, or processes represented outside it, where that connection is relevant to the mechanism examined under q .

Definitions 12.36 and 12.37 make internality and externality explicit analytical attributions. They do not imply that internal relations are stronger, more cooperative, more controllable, or more legitimate than external relations. Internal configurations can contain conflict, opacity, asymmetric authority, and weak coordination; external relations can be recurrent, trusted, highly integrated, or difficult to substitute. The distinction identifies where a relation sits relative to a selected boundary and what that position contributes to explanation.

Table 12.12 summarizes the principal dimensions developed in this section. The categories are illustrative and can overlap within a single empirical relation.

Proposition 12.38 (Boundary-relative internality). *The internal or external status of an economic relation is relative to the configuration, boundary, scale, and analytical purpose under study. A relation can be internal under one representation and external under another without contradiction when the relevant boundaries differ.*

Proposition 12.38 has methodological consequences. Empirical work should state the relevant boundary before interpreting internal or external effects, and comparisons across studies should examine whether the studies use compatible boundaries. The proposition also discourages a simple identification of internality with control. Some processes represented inside an organization may be weakly governed, while formally external infrastructures, creditors, standards, platforms, or regulators can exercise substantial influence over the feasible internal action space.

12.10.1 Internal Coordination

Internal coordination concerns the alignment of interdependent activities within a selected configuration. It can involve managerial direction, negotiated routines, schedules, workflow design, shared standards, information systems, professional norms, reciprocal adjustment, or combinations of these mechanisms. The analytical object is the relational architecture through which distributed activities become sufficiently coordinated for the configuration to reproduce or pursue a task.

The economic significance of internal coordination is well established in theories of the firm. Coase emphasized that some transactions are coordinated within firms

Table 12.12: Selected dimensions of internal and external economic relations.

Dimension	Relational object	Illustrative analytical questions
Coordination	Alignment of activities, sequences, roles, and expectations within a selected configuration	Which mechanisms align interdependent activities, and where do coordination burdens accumulate?
Authority	Capacity to issue, interpret, delegate, or enforce decisions within the selected boundary	Which positions can commit resources or alter rules, and how is authority distributed or contested?
Resource flow	Movement and allocation of material, financial, temporal, infrastructural, or other resources	Which internal pathways enable or constrain productive and distributive processes?
Knowledge flow	Production, transmission, withholding, interpretation, and retention of economically relevant knowledge	Which actors know what, through which channels, and with what delay or distortion?
Trust and conflict	Expectations, reliance, disagreement, bargaining, and contestation within recurrent relations	Where does reliance reduce coordination burdens, and where do conflicts reveal divergent positions or interests?
Exchange	Cross-boundary transfer of goods, services, claims, rights, or other economically relevant objects	Which boundary-crossing transfers connect the configuration to external participants?
Cooperation and competition	Cross-boundary collaboration, rivalry, complementarity, and strategic interdependence	Which external relations expand capabilities, constrain alternatives, or reshape positions?
Regulation	Rules, oversight, classification, and enforcement originating outside the selected configuration	How do external rules enter internal procedures, capacities, costs, and responsibilities?
Mediation	Third-party structures that enable, filter, certify, finance, coordinate, or govern cross-boundary relations	Which intermediaries alter access, information, trust, bargaining, or dependence?
Coupling	Reciprocal influence between internal organization and external conditions	How do internal changes propagate outward, and how do external changes reorganize internal relations?

because using the market mechanism itself can entail costs (Coase 1937). Williamson later analyzed governance structures as institutionally differentiated responses to transaction characteristics and contractual hazards (Williamson 2000). GRE can use these accounts without treating hierarchy or transaction-cost economizing as a com-

plete explanation of internal coordination. Internal arrangements can also be shaped by learning, professional practice, technology, legal duties, care relations, political negotiation, organizational identity, and inherited routines.

Coordination can be centralized or distributed. A centralized schedule may sequence tasks through a designated authority; distributed teams may coordinate through protocols, shared information, mutual adjustment, or repeated interaction. Hybrid arrangements are common. A production system can combine managerial authority, algorithmic scheduling, peer coordination, professional discretion, and external standards. The relevant question is which relations coordinate which activities under the conditions being examined.

Internal coordination also has a temporal structure. Earlier commitments can create dependencies that constrain later sequencing. Delays in one component can propagate through others. Organizational memory, routines, technical standards, and accumulated expectations can make some coordination pathways easier to reproduce than alternatives. The resulting configuration can therefore display path dependence even when individual participants change.

Coordination quality remains dimension-specific. Tight synchronization can improve throughput while reducing local discretion; flexible decentralization can preserve adaptation while increasing negotiation burdens. GRE treats these consequences as empirical and evaluative questions whose significance depends on the practical problem and the positions affected.

12.10.2 Internal Authority

Internal authority concerns the capacity of positions within a selected configuration to make, interpret, delegate, revise, or enforce decisions that affect other internal positions. Authority can arise through law, ownership, employment, office, professional status, contract, technical control, expertise, customary recognition, or historically stabilized practice. Several sources of authority can coexist and can support or conflict with one another.

Formal authority and effective authority should be distinguished. An organizational chart can assign decision rights to one office while technical expertise, control of information, budgetary discretion, access to infrastructure, or informal influence gives another actor substantial practical power. Conversely, a formally powerful position can depend on cooperation, implementation capacity, or external approval that limits its effective reach.

Authority is also object-specific. The capacity to allocate a budget does not necessarily confer authority over professional standards, personnel decisions, technical design, data access, or legal interpretation. Mapping internal authority therefore requires identifying the object of decision, the recognized source of authority, the mechanisms of implementation, and the avenues through which decisions can be questioned or revised.

Delegation creates further relational layers. A principal can authorize an agent, a board can delegate to management, management can delegate to units, and units can rely on technical systems or external contractors. Delegation can expand coordi-

nation capacity while distributing information and responsibility across several positions. The practical architecture of authority is therefore often recursive rather than reducible to a single chain of command.

Authority can be productive as well as restrictive. It can enable collective commitment, resolve coordination problems, allocate scarce resources, and support rapid response. It can also create dependence, suppress information, or concentrate the capacity to define relevant categories and priorities. Evaluation requires situated normative commitments and evidence about how authority operates in the configuration under study.

12.10.3 Internal Resource Flow

Internal resource flow concerns the movement, allocation, transformation, and retention of resources within a selected configuration. Relevant resources can include finance, materials, equipment, infrastructure, time, labor capacity, data, energy, access rights, attention, organizational support, and other objects that become economically consequential in the local process. Their internal movement can reveal capacities and constraints that aggregate resource totals conceal.

Resource flow is rarely neutral with respect to structure. Budget rules can privilege some units; technical architecture can make one team dependent on another; inventory practices can shift risk across locations; internal transfer rules can alter incentives; access controls can limit the convertibility of a nominal resource into effective capacity. A relational account therefore asks who can mobilize which resource, through which pathway, under what conditions, and with what residual obligations.

Internal allocation can occur through administrative decision, formula, negotiation, queue, entitlement, internal price, historical precedent, emergency priority, or decentralized request. Several mechanisms can operate simultaneously. Their interaction matters because the same nominal allocation can generate different capacities when access, timing, complementarities, or authority differ across positions.

Internal resource flows also connect to external relations. Revenue, credit, public funding, supplier inputs, infrastructure, household labor, ecosystem services, or data can enter the configuration from outside the selected boundary and be redistributed internally. Conversely, internal allocation choices can alter external demand, waste, emissions, employment, investment, or bargaining relations. Internal resource analysis therefore prepares the later study of internal–external coupling.

12.10.4 Internal Knowledge Flow

Internal knowledge flow concerns the production, transmission, interpretation, withholding, transformation, and retention of economically relevant knowledge within a configuration. Knowledge can concern tasks, technologies, demand, risk, regulations, relationships, local conditions, organizational history, tacit practice, or the state of the configuration itself. Its economic effects depend on who possesses it, whether it can be communicated, whether recipients can interpret it, and whether the institutional setting allows it to influence action.

Knowledge distribution is commonly uneven. Senior decision makers can possess

broad strategic information while frontline participants hold detailed operational knowledge. Specialists can understand technical risks that are weakly legible to general managers. Local units can observe changing conditions before central reporting systems register them. The economic problem therefore includes both information transmission and the relation between different forms of knowledge.

Formal reporting systems can improve comparability and accountability, while classification and aggregation can compress local context. Informal communication can transmit tacit or rapidly changing information, while dependence on informal channels can create opacity or exclusion. The appropriate balance varies with the task, stakes, scale, and temporal conditions.

Knowledge can also be strategically withheld or selectively disclosed. Confidentiality, bargaining, organizational politics, professional boundaries, data governance, security concerns, and competition can all affect internal information pathways. These conditions make knowledge flow a relational question involving authority, incentives, trust, and responsibility as well as a technical question of communication capacity.

Organizational learning depends partly on whether experience leaves accessible traces. Records, routines, shared vocabularies, post-event review, technical repositories, personnel continuity, and institutional memory can preserve learning across changes in membership. Their presence does not guarantee learning: stored information can remain unused, misclassified, or detached from the contexts needed for interpretation. Knowledge flow should therefore be studied together with the relations that make knowledge actionable.

12.10.5 Internal Trust and Conflict

Internal trust and conflict describe two recurrent dimensions of relations among participants who remain connected within a selected configuration. Trust can support reliance under incomplete monitoring, facilitate information sharing, reduce verification burdens, and make coordination possible where contracts or rules leave substantial discretion. Conflict can disclose incompatible interests, divergent interpretations, distributional disputes, failures of recognition, or competing understandings of the configuration's purposes.

Trust is relational and domain-specific. Confidence in a colleague's technical competence does not imply confidence in their distributive judgment; confidence that an organization will pay contractual obligations does not imply confidence that it will protect every stakeholder interest. Trust can also become misplaced or structurally induced where exit is costly and participants have few alternatives. The analysis should therefore specify the object and conditions of reliance.

Conflict similarly admits several forms. Bargaining conflict can concern the distribution of resources; jurisdictional conflict can concern authority; epistemic conflict can concern interpretation or evidence; normative conflict can concern legitimate priorities; procedural conflict can concern how decisions are made. These forms can coexist. Their economic significance depends on how they affect coordination, investment, participation, learning, and later relation formation.

Trust and conflict can also interact. Established trust may allow disagreement without immediate dissolution of the relation. Repeated unresolved conflict can erode reliance, while contestation can sometimes reveal information that a highly conforming organization suppresses. Neither trust nor conflict therefore carries a fixed normative value within GRE. Their significance is assessed through the particular capacities, dependencies, protections, and histories involved.

Behavioral and institutional research on collective action illustrates the importance of reciprocity, reputation, and trust in sustaining cooperation under some conditions (Ostrom 1998). GRE treats such findings as situated evidence for particular mechanisms and leaves open how those mechanisms operate across other organizational and historical contexts.

12.10.6 External Exchange

External exchange concerns cross-boundary transfers through which a selected configuration acquires, provides, trades, licenses, lends, rents, or otherwise transfers economically relevant objects with external participants. The object can be a good, service, financial claim, right, data access, license, capacity, or other transferable or conditionally accessible resource. Exchange is one important form of external relation, though external relations also include regulation, cooperation, dependence, mediation, and non-contractual exposure.

Market exchange provides a familiar case, but a relational account examines more than the recorded transaction. Search, certification, reputation, standards, payment infrastructure, logistics, contract enforcement, credit, and prior relationships can condition whether exchange is possible and on what terms. Granovetter's account of embedded economic action provides a classic reminder that economic transactions occur within ongoing social structures rather than among wholly atomized actors (Granovetter 1985).

External exchange can reshape internal organization. A new supplier can require technical redesign; a financing contract can impose reporting duties; outsourcing can move activities across a formal boundary while increasing dependence on external coordination; a large customer can change production priorities or quality systems. Exchange therefore links the architecture on each side of the selected boundary.

The boundary itself can also change through repeated exchange. Long-term contracting, integration of information systems, dedicated assets, shared standards, or recurrent personnel interaction can make formally external partners functionally close to internal operations. Analysis should preserve the formal distinction where relevant while also representing the practical degree of coupling.

12.10.7 External Cooperation and Competition

External cooperation and competition concern relations among distinct configurations whose activities become strategically interdependent. Cooperation can include alliances, joint ventures, research collaboration, shared standards, mutual aid, purchasing consortia, interoperability arrangements, or collective governance. Competition can concern customers, inputs, labor, finance, legitimacy, intellectual resources,

standards, policy influence, or positions within a broader field.

Cooperation and competition frequently coexist. Firms can collaborate on technical standards while competing in product markets; universities can share research infrastructure while competing for funding or personnel; jurisdictions can coordinate infrastructure while competing for investment. The relevant relation therefore cannot always be represented by a single cooperative or competitive label.

Interorganizational research provides evidence that collaboration can create learning opportunities and alter later network positions in some sectors (Powell et al. 1996). Network forms can also coordinate recurrent exchange through mechanisms distinct from both spot markets and administrative hierarchy (Powell 1990). GRE uses these findings as examples of how external relations can generate capacities and later opportunities while retaining attention to sectoral, institutional, and historical conditions.

Competition can likewise change relational architecture. Entry by a new competitor can alter supplier relations, labor demand, standards, investment, pricing practices, or alliance structures. Cooperative arrangements can generate exclusions or dependencies as well as shared capacity. Evaluation therefore requires analysis of which capacities and constraints are generated for differently positioned participants.

12.10.8 External Regulation

External regulation concerns rules, classifications, standards, oversight, adjudication, and enforcement originating in institutions represented outside the selected configuration but capable of altering its internal action space. Regulation can establish permissions, prohibitions, reporting duties, liability, eligibility, disclosure requirements, safety standards, labor protections, capital requirements, environmental conditions, or other constraints and capacities.

The external status of regulation is itself boundary-relative. A national regulator can be external to a firm while remaining internal to the national institutional configuration; a supranational rule can be external to a jurisdiction represented at one scale and internal to a larger legal order represented at another. Proposition 12.38 therefore applies directly to regulatory analysis.

Institutions shape interaction through rules and constraints that structure incentives and expectations (North 1990). In practice, external regulation commonly operates through internal translation. Organizations create compliance units, reporting routines, technical controls, documentation systems, training, or authorization processes that convert external rules into internal procedures. The effect of regulation therefore depends partly on the internal relations through which it is interpreted and implemented.

Regulation can also generate capacities. Certification can support trust; common standards can enable interoperability; legal recognition can make claims enforceable; reporting requirements can create information infrastructures; prudential rules can support system resilience under some conditions. These effects should be examined empirically alongside compliance costs, distributional consequences,

strategic responses, and possible regulatory gaps.

12.10.9 External Mediation

External mediation concerns third parties and infrastructures that enable, filter, certify, finance, coordinate, or govern relations across a selected boundary. Banks, exchanges, platforms, brokers, auditors, insurers, rating systems, standards bodies, payment networks, logistics providers, professional intermediaries, and public agencies can perform mediating functions. The relevant category depends on the mechanism under study and is not limited to commercial intermediation.

Mediators can reduce coordination burdens by matching participants, standardizing information, verifying identity or quality, pooling risk, settling payments, resolving disputes, or providing common infrastructure. They can also become gatekeepers when access to a relation depends on their classifications, technical interfaces, approval, pricing, or data. Mediation therefore alters the relational conditions under which otherwise external parties encounter one another.

A mediator's formal independence does not imply weak influence. Control over standards, rankings, search visibility, credit assessment, payment access, certification, or technical protocols can shape the feasible actions of participants without transferring formal ownership or managerial authority. Conversely, participants can sometimes discipline mediators through competition, governance rights, regulation, collective action, or technical alternatives. The resulting structure is an empirical question.

Mediation can also blur organizational boundaries. A platform can coordinate transactions among legally separate participants through common rules and technical architecture; a lead firm can coordinate suppliers through standards and information systems; an auditor can connect internal reporting to external investors and regulators. Such arrangements illustrate why economic boundary analysis should track effective relational pathways in addition to formal legal categories.

12.10.10 Internal–External Coupling

Internal–external coupling concerns the reciprocal pathways through which changes inside a selected configuration alter external relations and external changes reorganize internal relations. Coupling is therefore a property of the interaction between boundary-relative domains rather than an assertion that the boundary disappears. A boundary can remain legally or analytically useful while substantial causal influence crosses it.

External demand can alter internal production and staffing; credit conditions can change investment and governance; regulation can reorganize reporting and authority; supplier disruptions can change inventory strategy; technological standards can reshape internal architecture; labor-market conditions can alter bargaining and retention. Internal decisions can in turn affect prices, suppliers, workers, communities, infrastructures, public budgets, ecological conditions, and the formation of later external relations.

Coupling can be weak, strong, asymmetric, delayed, or nonlinear. A configuration

may depend heavily on one external infrastructure while exercising little influence over it. Another may shape the rules or standards on which many external participants depend. Some effects become visible quickly, while others accumulate through investment, learning, reputation, environmental change, institutional response, or path-dependent technical adoption.

Proposition 12.39 (Internal–external coupling). *Where a selected economic boundary is crossed by recurrent flows of resources, knowledge, authority, rules, obligations, or consequences, internal and external relations can become jointly constitutive of the configuration’s practical capacities. Explanatory adequacy then requires representing the cross-boundary mechanisms relevant to the target process while retaining a boundary resolution appropriate to the inquiry.*

Proposition 12.39 avoids two opposite simplifications. Treating the configuration as closed can omit external conditions on which its internal capacities depend. Expanding the boundary to include every causal influence can make the unit analytically unmanageable. GRE therefore treats boundary selection as a revisable modeling decision and asks whether omitted cross-boundary relations materially alter the explanation.

Internal–external coupling can also transform the boundary over time. Repeated outsourcing can externalize activities once treated as internal; vertical integration can internalize recurrent exchange; platform architecture can create new quasi-internal coordination among legally separate participants; regulatory reform can relocate responsibilities; technological interoperability can connect previously separated systems. The internal–external distinction therefore has a history as well as a scale.

Remark 12.40 (Boundary-relative coupling). Claims about internal or external effects should identify the boundary and scale to which the claim refers. Where conclusions change materially under another plausible boundary, that sensitivity is itself economically informative and may warrant comparison across representations.

The distinction developed in this section provides a basis for analyzing organizations as configurations that condense multiple internal relations while remaining constituted through external relations. The next section examines organizational emergence, roles, authority, coordination, memory, learning, and generativity with this boundary-relative architecture in view.

12.11 Organizations as Relational Condensations

Organizations occupy a distinctive position in economic architecture because they can stabilize memberships, roles, authority relations, coordination practices, resource commitments, knowledge pathways, records, and external interfaces across histories that outlast particular transactions or participants. This section develops organizations as *relational condensations*: comparatively stabilized configurations in which heterogeneous economic relations become sufficiently concentrated, differentiated, and reproducible to support organized capacities over time. Its objective is to clarify organizational emergence, membership, roles, authority, coordination, internal differentiation, external mediation, memory, learning, and generativity without

reducing an organization either to its legal shell or to the aggregate properties of its members. The discussion is relational and historical. It treats organizational form as a revisable analytical attribution whose explanatory value depends on the mechanisms under study, while legal, accounting, technical, spatial, and social boundaries remain empirically distinguishable.

Economic thought has long treated organizations as analytically significant forms of coordination. Coase's account of the firm emphasized that some activities are coordinated within firms because reliance on market exchange itself can involve costs (Coase 1937). Organizational law can also stabilize legally recognized entities and partition assets and claims in ways that give organizational boundaries material economic consequences (Hansmann and Kraakman 2000). Other arrangements, including networks and interorganizational collaborations, show that economically consequential coordination can extend across formal organizational boundaries (Powell 1990; Powell et al. 1996). GRE uses these traditions as complementary reference points. The present concept of relational condensation is intended to identify the patterned concentration and reproduction of relations that can make an organization economically consequential, while leaving open which mechanisms dominate in a particular case.

Definition 12.41 (Organizational relational condensation). For a specified analytical purpose and time horizon, an *organizational relational condensation* is a comparatively stabilized configuration in which memberships, roles, authority relations, coordination practices, resource commitments, knowledge pathways, records, and external interfaces are sufficiently organized to reproduce selected collective capacities or activities across changing events and participants. The relevant dimensions of condensation are empirical and need not coincide with a single legal, spatial, or technical boundary.

Definition 12.41 uses condensation as an analytical metaphor for relative concentration and stabilization. It does not imply immobility, closure, hierarchy, or normative desirability. A loosely coupled association can be organizationally consequential where recurrent roles, shared records, standards, and external recognition stabilize coordination. A formally incorporated entity can remain weakly condensed where authority, knowledge, resources, or participation are fragmented. Organizational analysis therefore requires attention to the dimensions through which the configuration is reproduced.

Table 12.13 summarizes the principal dimensions developed in this section. The dimensions are illustrative and can vary independently.

Proposition 12.42 (Dimension-relative organizational condensation). *The degree and form of organizational condensation are relative to the dimensions and time horizon selected for analysis. Strong stabilization of legal identity or authority can coexist with weak stabilization of membership, knowledge, routines, or external interfaces, and the reverse can also occur.*

Proposition 12.42 prevents organizational analysis from collapsing several distinct forms of persistence into one variable. An organization can maintain legal continuity through extensive personnel turnover, preserve routines while authority changes, retain a recognizable public identity while internal coordination fragments, or remain

Table 12.13: Selected dimensions of organizations as relational condensations.

Dimension	Relational object	Illustrative analytical questions
Emergence	Stabilization of recurring relations into an organizational configuration	Which interactions, commitments, rules, assets, or recognitions make organized activity reproducible?
Membership	Conditions linking participants to organizational rights, duties, access, exposure, and exit	Who participates in which capacity, and how do formal and effective memberships differ?
Roles	Recurrent positions carrying differentiated expectations, competencies, permissions, or obligations	Which activities and responsibilities are attached to positions rather than particular persons?
Authority	Relations through which some positions can commit resources, issue decisions, interpret rules, or coordinate others	How is authority constituted, delegated, contested, constrained, or redistributed?
Coordination	Mechanisms that align differentiated and interdependent activities	Which routines, standards, schedules, negotiations, or information systems produce workable joint activity?
Differentiation	Internal distribution of functions, knowledge, resources, status, exposure, and responsibility	Which internal distinctions generate specialization, complementarity, hierarchy, or fragmentation?
External mediation	Interfaces linking the organization to markets, institutions, networks, infrastructures, and publics	Which boundary positions translate, filter, certify, negotiate, or transmit external conditions?
Memory	Persistence of records, routines, artefacts, infrastructures, and interpretive conventions	Which past decisions and practices remain available to condition later organizational action?
Learning	Revision of routines, representations, roles, and coordination in response to experience or inquiry	What changes, who can authorize change, and which prior commitments constrain adaptation?
Generativity	Organizational production of later capacities, relations, subjects, institutions, and possibilities	What does the organization make easier, harder, thinkable, legitimate, or reproducible over time?

operationally integrated despite distributed legal entities. Empirical claims about organizational persistence should therefore specify what is persisting and through which mechanisms.

12.11.1 Organizational Emergence

Organizational emergence concerns the historical stabilization of relations into a configuration capable of reproducing selected activities or commitments beyond isolated transactions. Emergence can involve incorporation, association, recurrent contracting, shared infrastructure, pooled resources, role differentiation, rule formation, recognition by external institutions, or repeated coordination. The relevant mechanism can differ substantially across firms, cooperatives, public bodies, voluntary associations, research organizations, platform operators, and other organizational forms.

A relational account therefore treats organizational emergence as a process of selective stabilization. Repeated interaction alone need not create an organization. What matters is whether some combination of membership, authority, roles, resources, records, expectations, or external recognition becomes sufficiently durable to condition later action. Coase's theory identifies one important economic mechanism through which coordination can become internalized within a firm (Coase 1937). Network forms analyzed by Powell illustrate that persistent coordination can also develop through recurrent reciprocal relations that do not reduce to either spot-market exchange or unified hierarchy (Powell 1990). GRE leaves room for both patterns and for other empirically grounded mechanisms.

Organizational emergence can be gradual or event-concentrated. A group may accumulate routines and shared resources before receiving legal recognition; a new legal entity may be created quickly while operational capacities remain under construction. Merger, spin-off, public authorization, platform launch, emergency mobilization, or collective self-organization can create different temporal sequences. The order of these events can matter because earlier commitments shape later membership, trust, asset control, authority, and external expectations.

Emergence also has a boundary dimension. Some organizations are constituted through relatively clear legal membership and asset boundaries; others depend on contractors, volunteers, affiliated units, shared infrastructure, or external communities that are operationally important despite weaker formal inclusion. Organizational emergence should therefore be reconstructed through the relations that generate effective coordinated capacity rather than inferred solely from a date of incorporation or formal chart.

12.11.2 Membership

Organizational membership specifies relations through which subjects or entities acquire positions, rights, duties, access, exposure, recognition, or participation within an organizational configuration. Membership can be legal, contractual, professional, functional, representational, voluntary, customary, technical, or informal. These forms can overlap while carrying different practical consequences.

The analysis developed for economic boundaries and membership remains important here. Formal membership may provide voting rights, employment status, access to records, benefit eligibility, or fiduciary duties, while effective participation can depend on information, schedules, language, professional standing, technical ac-

cess, or informal acceptance. Conversely, actors formally outside the organization can remain economically entangled through subcontracting, franchising, financing, platform dependence, family relations, or shared infrastructure.

Membership can also be layered. A person can belong to a team, profession, union, project, subsidiary, and parent organization simultaneously, with partly different obligations and channels of representation. Organizational decisions can therefore affect members through several overlapping positions. Analysis should identify which membership relation is relevant to the mechanism being studied rather than assigning one total organizational status to the subject.

Entry and exit shape organizational generativity. Recruitment, admission, promotion, affiliation, dismissal, retirement, resignation, and transfer alter the composition of capacities and relations. Practical exit can differ from formal exit where pensions, confidentiality obligations, debt, reputational effects, data retention, professional networks, or dependency continue after membership ends. Membership is thus an event-ordered relation with a possible economic afterlife.

12.11.3 Roles

Organizational roles are recurrent relational positions to which activities, expectations, competencies, permissions, obligations, or representational functions are attached. Roles make some aspects of coordinated action portable across changes in personnel: a new treasurer, laboratory manager, nurse, engineer, auditor, or committee chair can inherit selected responsibilities without reproducing the predecessor's full history or identity.

Role stabilization supports continuity but can also simplify heterogeneous subjects. Formal descriptions often compress tacit practice, emotional labor, informal mediation, care, troubleshooting, and accumulated local knowledge. The effective role enacted in practice can therefore exceed the role described in contracts or charts. Empirical analysis should compare formal assignment with observed responsibilities, dependencies, information access, and expectations where those differences matter.

Roles can be complementary, overlapping, conflicting, or vacant. Complementarity allows specialization; overlap can provide redundancy or create ambiguity; conflict can arise when several roles impose incompatible obligations; vacancy can interrupt coordination even where the formal organizational entity remains intact. Role architecture therefore influences both capacity and vulnerability.

Roles also mediate responsibility. A decision can be organizationally attributed while its preparation, authorization, execution, and oversight are distributed across several roles. Clear role specification may improve traceability, yet elaborate division of labor can also diffuse responsibility. GRE therefore treats role differentiation as an empirical architecture of action and accountability rather than as automatic evidence of either efficiency or irresponsibility.

12.11.4 Authority

Organizational authority concerns relations through which some positions can commit resources, issue or interpret decisions, define procedures, assign tasks, evaluate

performance, represent the organization, or alter the feasible actions of other participants. Authority can be constituted through law, ownership, contract, professional expertise, appointment, election, technical control, control of information, convention, or combinations of these sources.

Formal and effective authority can diverge. A formally senior office may depend on technical specialists for operational judgment; a platform administrator can shape feasible action through software permissions; a finance unit can constrain projects through budget control; an informal coordinator can become central because others rely on accumulated knowledge. Organizational analysis should therefore identify the mechanisms through which authority becomes effective rather than infer control directly from title or legal status.

Authority can be delegated and nested. Boards delegate to executives, executives to managers, managers to teams, and organizations can delegate selected functions to contractors, algorithms, committees, or professional bodies. Delegation creates relations among authorization, discretion, monitoring, and responsibility. It can expand organizational capacity by distributing judgment, while also creating information asymmetries and ambiguity concerning accountability.

Authority is also historically revisable. Crisis, growth, technological change, regulatory reform, professionalization, or repeated coordination failure can redistribute authority. Temporary emergency powers can persist beyond the conditions that produced them; informal authority can become formalized; centralized control can be decentralized. These possibilities make the reproduction and transformation of authority part of organizational history rather than a fixed structural parameter.

12.11.5 Coordination

Organizational coordination aligns interdependent activities across roles, resources, time, and information. It can rely on managerial direction, schedules, routines, protocols, prices used internally, professional norms, meetings, digital systems, reciprocal adjustment, shared objectives, or negotiated conventions. Several mechanisms commonly coexist within the same organization.

Coordination creates economic capacity where differentiated activities need to occur in compatible sequences or combinations. A hospital, research laboratory, manufacturing facility, public agency, or software organization depends on specialized contributions whose value can depend on timing and mutual adjustment. The organizational problem therefore includes alignment as well as resource possession.

Information and attention constrain coordination. Simon's analysis of organizations in information-rich environments emphasizes that abundant information can make recipient attention scarce, making the allocation of attention an organizational design problem (Simon 1971). GRE extends this concern relationally: who receives which information, in what representation, with what authority to act, and at what point in a process can shape the practical effect of knowledge.

Coordination can become over-stabilized as well as under-stabilized. Highly routinized arrangements may support reliability under recurrent conditions while making unusual signals harder to interpret or act upon. Looser arrangements can support

local adaptation while increasing negotiation burdens or inconsistency. The relevant balance is problem-dependent and can change with scale, uncertainty, technology, and the history of the organization.

12.11.6 Internal Differentiation

Internal differentiation concerns the patterned distribution of functions, knowledge, resources, authority, status, exposure, and responsibility within an organization. Differentiation can create specialization and complementarity, but it can also generate internal boundaries, unequal dependencies, communication burdens, and divergent perspectives on organizational problems.

Functional differentiation assigns distinct tasks to units or roles. Hierarchical differentiation distributes authority across levels. Professional differentiation can create communities with their own standards and epistemic practices. Spatial and technical differentiation can separate sites, systems, or infrastructures. Financial differentiation can allocate budgets and performance responsibilities to units. These dimensions may overlap without forming one simple hierarchy.

Differentiation changes what the organization can know about itself. Local units can hold detailed situated knowledge that is difficult to aggregate; central units can observe cross-unit patterns that remain invisible locally. Reporting systems, metrics, meetings, audits, and digital traces mediate between these perspectives. Their representations can support coordination while also compressing local context. Organizational self-knowledge is therefore produced through a relational architecture of observation and representation.

Differentiation also shapes exposure. Some units can absorb volatility, delay, or compliance burdens on behalf of others; frontline roles can encounter risks generated by decisions elsewhere; support functions can become invisible despite their importance to organizational continuity. Aggregate organizational performance can therefore coexist with heterogeneous internal experiences and capacities. GRE retains these internal distributions when they are relevant to explanation or evaluation.

12.11.7 External Mediation

Organizations interact with external economic configurations through mediated interfaces. Sales teams, procurement units, legal departments, public-affairs offices, standards specialists, auditors, recruiters, banks, logistics providers, platforms, professional associations, and other boundary positions can translate between internal organization and external markets, institutions, networks, infrastructures, and publics.

External mediation involves more than transmission. Mediators can classify opportunities, filter information, certify compliance, negotiate commitments, interpret rules, sequence access, and transform external signals into internal decisions. They can therefore affect which external relations become organizationally visible and actionable. A regulator's rule, market price, scientific finding, community concern, or supplier constraint acquires organizational consequences through particular chan-

nels of reception and interpretation.

Organizations can also depend on external mediators that they do not control. Credit-rating agencies, payment infrastructures, cloud providers, certification bodies, dominant platforms, or professional gatekeepers can condition organizational access and feasible action. Formal externality therefore does not imply weak influence. The internal–external coupling developed in Section 12.10 remains central to organizational analysis.

Interorganizational networks can themselves become sites of learning and innovation. Powell, Koput, and Smith-Doerr's study of biotechnology emphasizes the importance of networks of collaboration for learning and innovation (Powell et al. 1996). Such cases caution against representing organizational capacity as wholly contained inside the organization's formal boundary. Some capacities are generated through durable external relations and shared infrastructures.

12.11.8 Organizational Memory

Organizational memory concerns the persistence of economically relevant traces of prior activity that can condition later organizational action. Memory can be carried by records, routines, standards, contracts, software, physical layouts, technical artefacts, archives, narratives, role expectations, professional practice, and the embodied knowledge of participants. These carriers differ in durability, accessibility, interpretability, and transferability.

Memory is selective. Organizations record some events and omit others; metrics preserve some dimensions and compress others; staff turnover can remove tacit knowledge while leaving formal procedures intact. Archive and record systems can preserve decisions without preserving the practical context through which those decisions became meaningful. Organizational memory should therefore be treated as a historically produced representation of prior activity rather than as a complete store of the past.

Routines are an important carrier of organizational continuity. Nelson and Winter's evolutionary analysis emphasizes routines, search, and organizational change as central to the dynamics of firms and industries (Nelson and Winter 1982). Within GRE, routines can be analyzed as recurrent relational patterns that preserve selected ways of coordinating, interpreting, and acting. Their persistence can support reliability and accumulated capability while also carrying assumptions formed under earlier conditions.

Memory can be distributed across internal and external infrastructures. Contractors, regulators, standards bodies, customers, suppliers, former members, and technical systems can retain records or expectations that shape later organizational action. An organization can therefore lose internal memory while remaining constrained by external traces of its history.

12.11.9 Organizational Learning

Organizational learning concerns changes in routines, representations, roles, coordination practices, resource commitments, or interpretive frames that arise through

experience, inquiry, interaction, or deliberate experimentation. Learning is organizationally significant when these changes become sufficiently embedded to influence later action beyond the cognition of a single participant.

Learning can occur through several pathways. Organizations can revise procedures after failure, incorporate external knowledge through recruitment or collaboration, experiment with alternative routines, update models after new evidence, or redistribute authority when existing channels prove inadequate. Learning can also occur through imitation, regulation, professional standards, and interorganizational networks. The relevant mechanism should be specified rather than inferred merely from observed change.

Learning can be uneven. One unit can revise while another preserves older routines; formal policy can change without practical implementation; individuals can learn while the organization fails to retain their knowledge; an organization can reproduce a new procedure without understanding the conditions under which it works. Organizational learning therefore has dimensions of acquisition, interpretation, retention, dissemination, and enactment that may diverge.

Learning also changes the object that future evidence addresses. Once routines, roles, technologies, or relationships have changed, evidence generated under the earlier organizational configuration may have limited transportability. Learning can therefore require continued observation of the reorganized system rather than treating the adopted lesson as permanently valid. This is especially important under rapidly changing or high-uncertainty conditions.

Remark 12.43 (Learning and retained revisability). Organizational learning is treated here as a historically situated capacity for revision rather than as monotonic improvement. A newly adopted routine or representation can later prove inadequate, and an organization can learn in ways that expand some capacities while reducing others. Claims of learning should therefore identify the changed object, the evidence of changed practice, and the relevant consequences.

12.11.10 Organizational Generativity

Organizational generativity concerns the ways organizational configurations participate in producing later capacities, relations, subjects, institutions, representations, and fields of possibility. Organizations do more than coordinate existing resources. They can train participants, stabilize professions, create technical standards, accumulate infrastructures, generate classifications, produce knowledge, establish reputations, form dependencies, alter markets, and reshape the conditions under which later organizations and subjects act.

Generativity can operate internally and externally. Internally, organizations can develop skills, routines, identities, authority structures, and technological capacities. Externally, they can create supply systems, standards, employment pathways, professional communities, contractual expectations, public categories, and infrastructural dependencies. These effects can persist after particular projects or memberships end.

Generativity also carries heterogeneous consequences. An organization can expand productive or epistemic capacity while concentrating authority, generating

dependency, externalizing risk, narrowing alternatives, or reproducing exclusions. GRE therefore separates the descriptive claim that a configuration generates later possibilities from the normative evaluation of those possibilities. The same generative process can affect differently situated participants in different ways.

Organizational generativity is history-dependent. Capabilities accumulated through earlier projects can support later innovation; reputational history can open or close partnerships; prior failures can reshape monitoring and authority; accumulated infrastructure can create path dependence; repeated classifications can stabilize categories that later actors inherit. Organizational history therefore enters future economic possibility through both material and relational carriers.

Proposition 12.44 (Organizational generativity beyond formal boundaries). *Where organizational activity changes capacities, relations, expectations, infrastructures, classifications, or dependencies outside the organization's selected formal boundary, analysis of organizational generativity may require a wider impact boundary than analysis of organizational membership or legal identity.*

Proposition 12.44 preserves the boundary discipline developed earlier in the chapter. It does not imply that every indirect consequence should be attributed to the organization. The relevant impact boundary should be justified by an identifiable mechanism and appropriate evidence. The proposition instead recognizes that organizations can be causally consequential through supply chains, labor markets, knowledge networks, standards, infrastructures, communities, and institutions that extend beyond formal membership.

Remark 12.45 (Organizations as revisable analytical condensations). The language of relational condensation is a heuristic for studying comparative stabilization and organized capacity. Where another representation better explains the relevant process—for example a network, institution, platform ecosystem, project coalition, or distributed infrastructure—GRE permits the organizational representation to be revised rather than treating organizational form as the privileged unit of analysis.

Organizations thus provide one comparatively stabilized form through which economic relations can be coordinated, remembered, learned, and made generative across time. Their capacities depend partly on rules and classificatory structures that can persist beyond particular organizations and condition many organizations simultaneously. These wider structures motivate analysis of institutions as relational infrastructure whose effects can extend across many organizational configurations.

12.12 Institutions as Relational Infrastructure

Institutions contribute to economic architecture by stabilizing recurrent conditions under which actors recognize positions, interpret conduct, form expectations, allocate authority, record entitlements, resolve disputes, and reproduce or revise rules. This section develops institutions as *relational infrastructure*: historically constituted configurations of formal rules, informal rules, norms, legal and administrative structures, classifications, expectations, records, and practices that condition recurring economic relations across events and, often, across organizational boundaries. Its objective is to distinguish institutional structure from particular organizations while

clarifying the mechanisms through which institutions acquire practical economic effects. The discussion is relational and historical. It treats institutional infrastructure as an analytical representation whose relevant components, boundaries, and durability depend on the inquiry, and whose reproduction can include reinterpretation, selective enforcement, contestation, and transformation.

Institutional economics provides several useful starting points for this analysis. North characterizes institutions as humanly devised constraints that structure interaction and shape incentives, while distinguishing institutions from organizations that operate within and act upon institutional environments (North 1990). Ostrom's work shows that institutional arrangements can be diverse, locally organized, layered, and dynamically revised rather than reducible to a single state–market opposition (Ostrom 1990; Ostrom 2005). Sociological and legal traditions add further dimensions: social norms can depend on expectations and conditional compliance (Bicchieri 2006); legal orders combine different kinds of rules and practices of recognition (H. L. A. Hart 2012); and classifications and standards can organize visibility, comparability, and action in ways that become infrastructural precisely because they are routinely embedded in practice (Bowker and Star 1999; Desrosières 1998). GRE draws on these traditions without treating any one institutional definition as exhaustive.

Definition 12.46 (Institutional relational infrastructure). For a specified economic inquiry and time horizon, *institutional relational infrastructure* is the comparatively stabilized configuration of rules, norms, recognized positions, classifications, procedures, expectations, records, enforcement capacities, and interpretive practices that conditions recurrent economic relations and their possible continuation or revision. Its components can be formal or informal, distributed across multiple organizations, and unevenly enacted across positions and settings.

Definition 12.46 uses infrastructure in a relational sense. The term points to recurrent conditions that make some actions, claims, classifications, and expectations easier to reproduce while constraining or redirecting others. It does not imply that institutions are fixed, hidden, neutral, or merely enabling. Institutions can become explicit objects of contestation, can distribute costs and capacities unevenly, and can be transformed through both formal reform and changes in interpretation or practice.

A second distinction concerns institutions and organizations. Organizations can possess members, offices, assets, procedures, and decision capacities. Institutions can structure the relations through which organizations and other actors operate, yet the two categories can overlap empirically. Courts, ministries, firms, universities, professional associations, standard-setting bodies, and community organizations can simultaneously be organizations and important sites of institutional reproduction. Their organizational continuity, however, should not be equated with the continuity of the institutions they enact.

Proposition 12.47 (Institution–organization non-equivalence). *Institutional persistence and organizational persistence are analytically separable. An institution can continue through organizational replacement or dispersion across several organizations, while an organization can persist through substantial change in the rules, norms, classifications, or expectations through which its economic relations are constituted.*

Proposition 12.47 makes the unit of analysis explicit. A property regime, accounting convention, licensing rule, professional norm, procurement practice, market classification, or welfare entitlement can survive changes in the organizations administering it. Conversely, the same organization can undergo institutional transformation when its operative rules, interpretive conventions, classifications, or recognized positions change.

Table 12.14 summarizes the principal dimensions developed in this section. The dimensions are illustrative and can overlap within the same institutional configuration.

12.12.1 Formal Rules

Formal rules are codified prescriptions, permissions, prohibitions, procedures, eligibility conditions, and decision criteria that receive recognized standing within an institutional order. They can appear in legislation, regulation, contracts, constitutions, organizational statutes, technical standards, accounting frameworks, benefit rules, procurement procedures, or other documentary forms. Their economic importance arises partly from the relations they authorize, restrict, classify, or make enforceable.

A relational account distinguishes the textual existence of a rule from its enacted effects. The same formal rule can be interpreted differently across offices, jurisdictions, industries, or historical periods. Its operation can depend on administrative capacity, information, resources, recognized authority, enforcement, professional judgment, technological systems, and the responses of affected actors. Formal codification therefore provides an important source of institutional stabilization without producing a mechanically self-applying economic order.

Hart's analysis of legal systems is useful for distinguishing rules that govern conduct from rules concerning recognition, change, and adjudication (H. L. A. Hart 2012). In economic settings, analogous distinctions can matter because rules that define a transaction, entitlement, organizational status, reporting obligation, or licensing condition often coexist with rules specifying who may alter, interpret, certify, or enforce those arrangements. Institutional analysis therefore benefits from asking both what the formal rule states and how authority over the rule is relationally organized.

Remark 12.48 (Rule text and enacted rule). For empirical purposes, a formal rule can be represented through at least two analytically distinguishable objects: its documented formulation and its recurrent enactment in practice. Their divergence can itself become economically consequential.

12.12.2 Informal Rules

Informal rules are recurrent practical conventions, expectations, and understandings that guide conduct without being fully codified in authoritative form. They can concern bargaining, reciprocity, seniority, hiring, promotion, payment timing, professional conduct, access to information, acceptable negotiation, conflict handling, or the practical interpretation of formal procedures. Their economic relevance can become substantial when actors coordinate around them, expect others to follow them, or anticipate costs from violation.

Table 12.14: Selected dimensions of institutional relational infrastructure.

Dimension	Relational object	Illustrative analytical questions
Formal rules	Codified prescriptions, permissions, procedures, and conditions	Which recognized rules structure access, obligation, authority, transfer, or sanction?
Informal rules	Recurrent practical conventions and expectations without full codification	Which unwritten practices condition what participants regard as feasible, expected, or acceptable?
Norms	Socially sustained expectations carrying evaluative or sanctioning force	Whose expectations matter, under what conditions, and how is compliance produced or contested?
Legal structures	Rights, duties, powers, liabilities, statuses, and procedures backed by legal institutions	How do legal relations constitute positions, entitlements, authority, and enforceable claims?
Administrative structures	Procedures, offices, records, eligibility rules, and implementation routines	How are general rules translated into recurring decisions and material access?
Classification systems	Categories that sort persons, entities, activities, resources, and events	Which distinctions become visible, comparable, eligible, taxable, reportable, or governable?
Expectations	Anticipations concerning conduct, enforcement, continuity, and others' responses	Which expectations coordinate action, and how can expectations become self-reinforcing or destabilized?
Memory	Records, precedents, routines, archives, infrastructures, and retained interpretive conventions	Which past decisions remain available to condition later institutional action?
Reproduction	Recurring enactment, interpretation, compliance, enforcement, teaching, and recording	Through which practices is an institution maintained or altered across events?
Change	Revision of rules, categories, expectations, practices, enforcement, or recognized positions	Which changes modify the operative relational infrastructure and which remain nominal?

Informality should not be equated with weakness. Some informal practices can be highly persistent and widely recognized; some formal rules can be weakly enacted. The analytical question concerns the mechanisms through which a practical regularity becomes consequential. Repetition, mutual expectation, reputation, social sanction, professional identity, dependency, local knowledge, and complementarity with

formal arrangements can each contribute.

Informal rules can also modify the operation of formal institutions. A formally open application procedure can coexist with informal gatekeeping. A formal reporting requirement can be shaped by tacit conventions about what counts as a problem worth escalating. A formal market can rely on informal trust and reputational expectations. These interactions make institutional configurations difficult to understand through documentary rules alone.

12.12.3 Norms

Norms are socially sustained expectations concerning appropriate, obligatory, permissible, or disapproved conduct. In economic life they can shape repayment, reciprocity, workplace conduct, professional responsibility, care obligations, acceptable profit-seeking, disclosure, stewardship, consumption, or participation in collective arrangements. Normative force can arise through internalized commitments, anticipated sanctions, expectations about others, identity, reputation, or combinations of these mechanisms.

Bicchieri's analysis is useful because it relates norm compliance to empirical and normative expectations rather than treating norms as undifferentiated cultural background (Bicchieri 2006). GRE retains this mechanism-sensitive orientation while allowing that norms can operate through heterogeneous pathways in different settings. A norm can be widely stated but weakly enacted, locally powerful but institutionally unrecognized, or internally contested among differently positioned participants.

Norms also require scope discipline. Describing a recurrent expectation does not establish its ethical legitimacy. A norm can coordinate valuable cooperation, stabilize exclusion, reproduce hierarchy, protect vulnerable participants, or combine these effects across different positions. Normative desirability therefore remains a separate inquiry from institutional persistence or causal efficacy.

Remark 12.49 (Normative persistence and evaluation). The persistence of a norm is evidence about institutional reproduction, not by itself evidence that the norm should be preserved. GRE keeps descriptive, causal, and normative analyses distinguishable even when they concern the same institutional relation.

12.12.4 Legal Structures

Legal structures organize economic relations through recognized statuses, rights, duties, powers, liabilities, procedures, and remedies. Property, contract, corporate form, insolvency, taxation, labor status, licensing, trust, public authority, and regulatory obligations can each alter who may act, who may exclude, who bears liability, which claims survive organizational change, and how disputes are resolved. Legal structure is therefore economically constitutive in many settings rather than merely an external constraint upon already formed market relations.

Hohfeld's decomposition of legal positions into correlatives such as rights and duties and into powers, liabilities, privileges, and immunities illustrates the value of treating law relationally (Hohfeld 1919). Organizational law provides a concrete economic example: legal forms can partition assets and claims, thereby altering the re-

lations among owners, managers, organizational creditors, and personal creditors (Hansmann and Kraakman 2000). These legal arrangements can stabilize economic entities and transactions while remaining historically revisable.

Legal structure should nevertheless be distinguished from enacted relational structure. Formal law can be interpreted, mediated, selectively enforced, strategically used, or partially displaced by social ordering. Moore's account of semi-autonomous social fields is relevant here because it shows how social fields can generate rules and induce compliance while remaining embedded in wider legal environments (S. F. Moore 1973). The empirical effect of law can therefore depend on its interaction with organizations, administrative practices, social expectations, and material capacities.

12.12.5 Administrative Structures

Administrative structures translate general institutional commitments into recurrent procedures, records, determinations, permissions, classifications, payments, inspections, and sanctions. Offices, forms, databases, review procedures, eligibility criteria, reporting systems, professional roles, and implementation routines can determine whether a nominal right or obligation becomes practically accessible and how consistently it is applied.

This translation can have independent economic significance. Two jurisdictions can share similar statutory language while producing different practical access because administrative capacity, documentation requirements, discretion, information systems, staffing, or appeal procedures differ. Within one jurisdiction, actors can experience the same nominal institution differently because their ability to navigate administrative structures is unequal.

Administrative structures also generate evidence. Records created for taxation, benefits, licensing, inspection, or service delivery can later become data through which institutions understand the populations and activities they govern. Such records can improve observability, yet their categories and collection procedures also shape what becomes visible. The informational function of administration is therefore connected to the classification systems considered below.

12.12.6 Classification Systems

Classification systems sort persons, organizations, activities, resources, transactions, risks, occupations, industries, jurisdictions, or events into categories that can be recognized and acted upon. Economically consequential classifications include employment status, corporate form, tax category, eligibility class, accounting item, industrial sector, credit category, property type, residency status, and numerous administrative or technical classifications.

Classification can make heterogeneous cases comparable enough for recurrent institutional action. Statistical histories analyzed by Desrosières show how coding, aggregation, and categories participate in the construction of standardized objects of quantitative knowledge (Desrosières 1998). Bowker and Star similarly emphasize that classifications and standards can become embedded infrastructures that shape visibility and interaction (Bowker and Star 1999). In GRE, this means classification is

potentially both epistemic and practical: it can describe an economic configuration while also modifying access, obligations, recognition, prices, monitoring, or organizational responses.

The consequences of classification depend on where the category is used and what relations it activates. The same label can be descriptive in one setting and eligibility-determining in another. Classification can improve coordination and reduce ambiguity, while also compressing heterogeneity, producing boundary cases, or creating incentives to reorganize behavior around the category. The category's practical effects therefore require empirical tracing.

Proposition 12.50 (Institutional classification as a potentially performative relation). *When a classification changes recognized status, access, obligation, authority, evaluation, or anticipated response, the act of classification can become part of the economic relation it represents. The strength and direction of this performative effect remain empirical questions.*

Proposition 12.50 is intentionally conditional. Many classifications remain primarily descriptive. Others become consequential because organizations, markets, public authorities, or participants act upon them. The relevant inquiry concerns the pathway through which representation enters later events.

12.12.7 Expectations

Institutions can stabilize expectations about what others are likely to do, what conduct will be recognized, which procedures will be followed, how rules will be enforced, and whether commitments will persist. Such expectations can reduce some forms of uncertainty and make coordination possible across actors who do not share detailed personal knowledge. They can also become fragile when enforcement, classification, policy, organizational practice, or wider historical conditions change.

Institutional expectations are heterogeneous. Some concern descriptive anticipation: participants expect a payment system to operate or a licensing office to apply a known procedure. Others concern normative expectations about appropriate conduct. Still others concern anticipated reactions to rules, announcements, rankings, or classifications. These forms can interact but should not be collapsed into one generic expectation variable.

Expectations can also participate in feedback. Merton's account of self-fulfilling prophecy provides a classic mechanism in which a socially consequential definition helps generate behavior that contributes to producing the anticipated condition (Merton 1948). In institutional settings, expectations about creditworthiness, organizational stability, policy continuity, market participation, or rule enforcement can sometimes alter behavior in ways that stabilize or destabilize the expected configuration. Such feedback should be demonstrated rather than assumed.

12.12.8 Institutional Memory

Institutional memory concerns the ways past rules, decisions, classifications, cases, interpretations, records, routines, infrastructures, and learned expectations remain available to condition later action. Memory can reside in statutes, case records,

archives, databases, procedural manuals, precedents, standards, professional training, organizational routines, material infrastructures, or tacit interpretive practices distributed across participants.

Institutional memory therefore differs from a complete historical record. Some events are recorded densely, others sparsely, and some forms of experience remain outside official documentation. Records can be lost, inaccessible, selectively retained, reclassified, or made legible only through later interpretive frameworks. Memory is consequently distributed and selective, and its practical accessibility can vary across positions.

The economic effect of memory can be substantial. Past classifications can condition future eligibility; precedents can influence interpretation; historical defaults can structure software and administrative routines; accumulated records can lower verification costs; and earlier exclusions can remain encoded in present infrastructures. Institutional memory can thus support continuity while also carrying historical path dependence into later decisions.

Remark 12.51 (Distributed institutional memory). Institutional memory can be distributed across documents, organizations, technologies, professional communities, and embodied practice. Locating the relevant memory therefore requires tracing the mechanisms through which past events remain accessible to later institutional action.

12.12.9 Institutional Reproduction

Institutional reproduction occurs when rules, norms, classifications, expectations, positions, and procedures remain practically available through recurrent enactment across events. Reproduction can involve compliance, enforcement, teaching, certification, documentation, imitation, interpretation, resource commitment, and the repeated recognition of statuses or boundaries. It can also involve incremental modification. Exact repetition is therefore only one possible form of institutional continuity.

Giddens's account of structuration emphasizes that rules and resources can be recursively implicated in the practices through which social structures are reproduced (Giddens 1984). GRE uses a compatible but more modest proposition: institutional infrastructure can persist because actors repeatedly draw upon it while acting, and their actions can simultaneously modify the conditions available for later action. The relevant empirical task is to identify which mechanisms carry continuity and which introduce change.

Reproduction is also uneven. Different actors can reproduce different parts of an institution, and institutional continuity at one scale can coexist with transformation at another. A classification can remain formally stable while its interpretation changes. A norm can persist within one profession while weakening elsewhere. A legal entitlement can remain codified while administrative access changes. Claims of institutional persistence should therefore specify the relevant dimension and scale.

Proposition 12.52 (Reproduction through situated enactment). *Institutional continuity can be generated through recurrent situated enactment rather than exact replication. Persistence in recognized positions, procedures, expectations, or classifications can co-*

exist with local variation in interpretation and practice.

Proposition 12.52 gives institutional persistence an event-historical interpretation. The institution is reconstructed through sequences of enactment, recognition, interpretation, recording, enforcement, and contestation. This representation allows stability and gradual change to be analyzed within the same historical architecture.

12.12.10 Institutional Transformation

Institutional transformation concerns changes in the relational infrastructure through which economic interaction is organized. Transformation can occur through formal legal reform, altered administrative practice, new classification systems, shifts in norms, changes in expectations, technological mediation, organizational reconfiguration, reinterpretation, changed enforcement, crisis, collective action, or combinations of these processes. The relevant transformation may be abrupt or gradual and may operate unevenly across scales.

Formal change is therefore one possible indicator of institutional transformation rather than a complete measure of it. A statutory amendment can have limited practical effect if administrative routines, classifications, resources, and expectations remain unchanged. Conversely, institutional practice can change substantially before formal rules are rewritten. The distinction between formal rule and enacted relational structure is especially important when evaluating reform.

Transformation can also alter the conditions under which later institutional change occurs. New rights can create new claimants and organizations; new classifications can reorganize data and eligibility; new technologies can redistribute monitoring capacity; new administrative routines can alter information flows; and changed expectations can affect compliance or contestation. Institutional change can therefore be generative in the descriptive sense developed throughout GRE: it can modify later capacities, relations, boundaries, and possible histories.

Remark 12.53 (Institutional transformation and normative evaluation). The capacity of an institutional transformation to generate new relations or possibilities does not establish that the transformation is desirable. Evaluation requires separate attention to the affected positions, values, capacities, risks, exclusions, responsibilities, and historical conditions relevant to the inquiry.

Institutions, on this account, are neither static containers around economic action nor interchangeable with the organizations that enact them. They are historically reproduced relational infrastructures whose rules, norms, legal positions, administrative practices, classifications, expectations, and memories condition recurring economic relations while remaining open to contestation and revision. This perspective prepares analysis of more specific institutional configurations—including markets—without presuming that any one institutional form exhausts the economic domain.

12.13 Markets as Relational Fields

Markets are economically consequential because they can coordinate heterogeneous participants, exchanges, prices, information, expectations, competitive pressures, co-

operative practices, and intermediating institutions across relations that extend beyond any single transaction. This section develops markets as *relational fields*: historically constituted configurations in which participation conditions, exchange relations, price formation, information, expectations, competition, cooperation, intermediation, and boundary practices jointly condition what transactions are possible and how their consequences propagate. Its objective is to preserve the analytical importance of price-mediated exchange while situating that process within the wider relational architecture that makes market participation, comparison, enforcement, interpretation, and adaptation possible. The discussion is economic, institutional, and historical. It treats a market field as a revisable analytical representation rather than a self-evident natural boundary, and it leaves open which mechanisms are dominant in a particular case.

Several established traditions motivate this broader treatment. Walrasian analysis demonstrates the analytical power of representing interdependent prices and quantities within systems of exchange (Walras 1874). Hayek emphasizes the coordination problem created by knowledge that is dispersed, incomplete, and unevenly held across participants, and the role that price changes can play in communicating selected information through decentralized adjustment (Hayek 1945). Granovetter shows that economic action remains embedded in ongoing social relations rather than occurring among fully atomized actors (Granovetter 1985). Polanyi's historical analysis further emphasizes that market organization is instituted within broader social and political arrangements and can itself transform those arrangements (Polanyi 1944; Polanyi 1957). GRE treats these contributions as analytically complementary rather than mutually exclusive: prices, institutions, social relations, expectations, and organizational forms can each become causally important under different market conditions.

Definition 12.54 (Market relational field). For a specified class of economically relevant exchanges, participants, objects, and time horizon, a *market relational field* is a comparatively stabilized yet revisable configuration of participation conditions, exchange relations, price relations, information pathways, expectations, competitive and cooperative relations, intermediaries, institutional supports, and boundaries through which exchange possibilities are formed, compared, enacted, and transformed. The relevant field can be local, sectoral, platform-mediated, national, transnational, or otherwise delimited according to the mechanism under study.

Definition 12.54 does not require that every market contain the same institutional arrangements or that every economically relevant exchange occur through a market. The definition identifies a family of configurations in which exchange and comparison are recurrently organized. It is compatible with highly decentralized exchange, organized exchanges, auction systems, platform markets, regulated markets, informal markets, and other arrangements, provided that the empirical mechanisms supporting participation and exchange are specified.

The field language also requires restraint. A market field is not presumed to possess a literal physical field ontology. The term is useful when participants and transactions are conditioned by a wider configuration of prices, expectations, rules, infrastructures, networks, classifications, and intermediaries whose effects cannot be

adequately represented as a single isolated dyad. Where such wider conditioning is weak, a simpler transactional representation can be preferable.

Table 12.15 summarizes the principal dimensions developed in this section. The dimensions can overlap and need not be equally salient in every market configuration.

12.13.1 Participation

Market participation concerns more than the formal permission to buy or sell. It can depend on legal status, identity verification, access to money or credit, information, infrastructure, language, technical compatibility, geographic reach, reputation, organizational membership, regulatory eligibility, and the practical ability to bear risk or wait for settlement. Participation is therefore a relational capacity constituted through several of the boundary and access dimensions developed earlier in this chapter.

The set of participants can also be stratified by role. Buyers, sellers, brokers, market makers, platforms, exchanges, lenders, insurers, rating bodies, regulators, data providers, payment processors, and other actors can occupy different positions within the same field. Their capacities to observe, initiate, delay, refuse, price, rank, or settle transactions can differ substantially. A market analysis that records only final buyers and sellers can therefore omit relations that materially condition exchange.

Formal openness and effective participation should consequently be distinguished. A market can be legally open while practical participation remains concentrated because transaction size, technical requirements, information costs, accreditation, geography, capital requirements, or network access create substantial entry conditions. Conversely, informal participation can arise outside formally recognized channels. The relevant empirical question concerns which conditions actually organize participation for the process under study.

Remark 12.55 (Participation as a differentiated capacity). Market participation can be represented as a bundle of differentiated capacities—including entry, observation, comparison, negotiation, transaction, settlement, exit, and redress—rather than as a single binary membership variable. Which capacities matter depends on the market mechanism being analyzed.

12.13.2 Exchange Relations

Exchange relations organize transfers of goods, services, claims, access, labor, information, rights, or other economically recognized objects under specified terms. Their market form depends on more than the physical movement of an object. The exchange can require recognized ownership or authority to transfer, contractual interpretation, quality assessment, payment infrastructure, settlement, enforcement, and expectations concerning counterpart performance.

The same observable transfer can also participate in several relation-forms at once. A labor contract can contain exchange, authority, knowledge, dependency, trust, and legal relations. A credit transaction can combine transfer, future obligation, collateral

Table 12.15: Selected dimensions of markets as relational fields.

Dimension	Relational object	Illustrative analytical questions
Participation	Conditions governing practical entry, recognition, access, eligibility, and capacity to transact	Who can participate, under which conditions, with what resources, rights, information, and practical alternatives?
Exchange	Reciprocal, contractual, or otherwise organized transfer relations	What is exchanged, under which obligations, and through which institutional and relational supports?
Prices	Monetary or other quantified terms that condition comparison and exchange	How are prices formed, interpreted, transmitted, constrained, and incorporated into later action?
Information	Unevenly distributed signals, records, knowledge, classifications, and disclosures	Which information becomes available to whom, through which channels, and with what delay or asymmetry?
Expectations	Anticipations concerning prices, conduct, availability, policy, quality, and others' responses	How do expectations coordinate or destabilize participation and exchange?
Competition	Relations through which participants contest opportunities, customers, inputs, positions, or standards	Which dimensions of competition matter, and which institutional conditions structure them?
Cooperation	Joint practices that support standards, infrastructures, information, interoperability, or collective provision	Which cooperative relations make exchange possible or reshape competitive conditions?
Intermediation	Positions that connect, filter, certify, match, clear, finance, rank, or otherwise mediate exchange	Which intermediaries alter access, information, bargaining conditions, or transaction pathways?
Boundaries	Practical and analytical distinctions defining which participants, objects, transactions, and substitutes belong to the field	Who defines the market boundary, for which purpose, and how does the boundary affect analysis or governance?
Formation and transformation	Historical processes that create, stabilize, expand, segment, integrate, or reorganize market relations	Which institutional, technological, organizational, and behavioral changes reshape the field over time?

relations, information asymmetry, and institutional enforcement. Market exchange should therefore be treated as one relational dimension within a thicker configuration rather than as evidence that other relation-forms have disappeared.

Coase's analysis of the firm remains useful because it makes the institutional organization of exchange itself economically relevant: using market exchange can involve search, contracting, negotiation, monitoring, and other costs, while organization can substitute different coordination mechanisms for some transactions (Coase 1937). GRE extends the analytical implication without presuming a universal market–hierarchy dichotomy. Network coordination, common arrangements, platforms, professional institutions, and hybrid forms can combine market exchange with other mechanisms (Powell 1990; Ostrom 2010).

12.13.3 Price Relations

Prices are among the most visible relational objects in market analysis because they summarize terms under which exchange can occur and can transmit information relevant to decentralized adjustment. Their analytical importance is substantial. Price changes can alter production plans, consumption choices, entry, substitution, investment, inventory, expectations, and the relative attractiveness of alternative transactions. Hayek's account emphasizes that such adjustment can make use of dispersed knowledge without requiring that a central actor possess all underlying information (Hayek 1945).

A relational account nevertheless separates the observed price from the complete structure producing and responding to it. A quoted price can depend on auction rules, bargaining power, market-making practices, inventory, credit conditions, regulation, platform design, expectations, quality classification, information asymmetry, and the available set of alternatives. Similar prices can therefore arise under different relational configurations, and identical price changes can carry different meanings for differently positioned participants.

Prices can also become performative when they enter later decisions and thereby affect the conditions from which future prices are generated. The effect can be direct, as when a price threshold triggers a contract or margin call, or indirect, as when price histories alter expectations, rankings, investment, or regulatory attention. The existence and magnitude of such feedback are empirical matters. MacKenzie's analysis of financial models provides a prominent case in which representations and models can become incorporated into market practices and contribute to reshaping the markets they describe (MacKenzie 2006).

Proposition 12.56 (Price–configuration non-equivalence). *Observed price relations do not uniquely identify the relational configuration that generated them. Market analysis can therefore require evidence about institutions, participation, information, bargaining, intermediation, and expectations when these mechanisms materially affect price formation or response.*

Proposition 12.56 is an epistemic caution rather than a rejection of price analysis. In settings where price mechanisms dominate and the relevant institutional conditions are stable, price-centered models can be highly informative. The proposition becomes important when different underlying configurations produce similar observables or when institutional and relational change alters the interpretation of price movements.

12.13.4 Information Relations

Markets are also organized through information relations. Participants differ in what they know about quality, availability, costs, counterparties, future conditions, rules, technologies, and alternatives. Information can arrive through prices, contracts, ratings, disclosures, advertising, reputation, professional networks, public statistics, platform interfaces, direct experience, and informal communication. The resulting information structure is therefore distributed across heterogeneous channels rather than reducible to a single common information set.

Information itself has distinctive economic properties. Arrow's analysis of invention emphasizes uncertainty and appropriation problems that make information and knowledge difficult to treat as ordinary commodities (Arrow 1962). More generally, the capacity to produce, verify, conceal, certify, rank, or interpret information can become economically consequential even when the information is nominally available to everyone. Information access and epistemic capacity should therefore be distinguished.

Market information can also be selectively legible. Standardized classifications, accounting categories, ratings, benchmarks, prices, and platform metrics make some properties easy to compare while leaving others difficult to observe. This can facilitate exchange while compressing heterogeneity. The effect is especially important where participants adapt behavior to the representation used for evaluation or ranking. In such cases, the information relation and the market relation can co-evolve.

12.13.5 Expectations

Expectations connect present market relations to anticipated future events. Participants can form expectations about future prices, demand, supply, policy, interest rates, technology, quality, counterpart behavior, market access, or the responses of other participants. These expectations can influence present orders, investment, inventories, hiring, credit, entry, exit, and contractual design.

Expectations can arise through heterogeneous processes. Some are produced through formal models or forecasts; others through experience, routines, professional narratives, imitation, public announcements, market indicators, or network communication. The same observable forecast can also have different consequences depending on who receives it, what authority is attributed to it, and which actions become available in response.

Expectations can generate feedback when anticipatory action alters the future conditions being anticipated. Such feedback need not be stabilizing. Expectations can support coordination when participants converge on compatible assumptions, but they can also amplify volatility, crowding, or abrupt revaluation when many actors respond similarly to the same representation. GRE therefore treats expectations as relationally situated epistemic conditions whose practical effects depend on institutional and market structure.

12.13.6 Competition

Competition concerns relations through which participants contest customers, inputs, contracts, attention, positions, standards, financing, labor, intellectual resources, or other opportunities. Its form depends on what can be contested, who can enter, which substitutes exist, how information is distributed, what switching costs apply, and which institutional rules structure conduct. Competition is therefore a relational pattern rather than a self-explanatory property of a market label.

Competitive relations can operate through price, quality, innovation, speed, reputation, interoperability, access, location, service, data, standards, or other dimensions. The relevant dimensions can change historically. Network effects can make installed participation itself economically important, so that the value of a product or system depends partly on how many others use compatible systems (Katz and Shapiro 1994). Under such conditions, competition can concern the architecture of compatibility and installed networks as much as the price of an isolated product.

Competition also interacts with organizational and institutional structure. Rules concerning entry, ownership, intellectual property, procurement, interoperability, disclosure, labor mobility, and finance can alter competitive possibilities. An account of competition should therefore specify the relevant field and mechanism rather than infer competition solely from the presence of multiple sellers or buyers.

12.13.7 Cooperation

Market fields can contain cooperation alongside competition. Participants may jointly establish standards, payment systems, clearing arrangements, shared infrastructures, professional practices, certification systems, interoperability protocols, research collaborations, or collective governance arrangements. Cooperation can reduce coordination costs, enlarge the field, improve compatibility, or stabilize expectations while leaving substantial competition in other dimensions.

This coexistence is visible in network forms of organization, where reciprocal communication and repeated relationships can organize economic activity beyond both spot exchange and unified hierarchy (Powell 1990). Polycentric arrangements similarly show that multiple centers of decision can combine autonomy, coordination, and shared rules in complex economic systems (Ostrom 2010). These examples support a broader analytical point: competitive and cooperative relations can be jointly constitutive of the same market field.

Cooperation has no automatic normative status. Shared standards can enable participation while also raising entry costs; joint infrastructures can distribute capacity widely or concentrate control; information sharing can improve coordination or facilitate exclusion. GRE therefore separates the presence of cooperation from judgments concerning its distributional, political, or ethical consequences.

Remark 12.57 (Competitive-cooperative composition). A market field can contain simultaneous competition and cooperation across different relational dimensions. Analysis should identify the object and mechanism of each relation rather than assign the field a single competitive or cooperative character.

12.13.8 Intermediation

Intermediaries occupy positions between participants, transactions, information sources, or institutional systems. Brokers, dealers, exchanges, banks, platforms, clearing organizations, rating agencies, certifiers, wholesalers, matching services, payment processors, and other actors can reduce some search or coordination burdens while introducing new dependencies, fees, filters, classifications, and control points.

Intermediation can affect who encounters whom, which offers become visible, how quality is certified, how risk is allocated, how payment is settled, which information is collected, and how disputes are resolved. An intermediary can therefore become economically consequential without acquiring ownership of the exchanged object. Its position can generate capacities through connectivity and coordination while also creating bottlenecks or asymmetric dependence.

Digital platforms make this especially visible because participation, ranking, payment, reputation, matching, access rules, data collection, and technical standards can be concentrated within one mediating infrastructure. Chapter 12 treats platforms and infrastructures separately because those configurations can extend beyond market intermediation. Within the present section, the narrower point is that intermediation can become part of the market field's architecture and should be represented when it materially conditions exchange.

12.13.9 Market Boundaries

A market boundary specifies which participants, products, services, locations, time horizons, technologies, substitutes, and institutional conditions are treated as belonging to the same market for a particular inquiry. Such boundaries can be practically consequential and analytically contested. A competition authority, a firm, a platform operator, a trader, and a researcher can draw different boundaries because they are answering different questions.

Market boundaries can be organized through geography, substitutability, regulation, language, technical compatibility, logistics, licensing, payment systems, network membership, customer practice, or other mechanisms. They can also be porous. Imports can connect previously separated price systems; digital platforms can create cross-border exchange; standards can integrate some participants while excluding incompatible systems; and regulation can segment markets that would otherwise share suppliers or consumers.

Rodrik's analysis of international economic integration illustrates how market integration interacts with jurisdictional and political boundaries rather than simply dissolving them (Rodrik 2000). More generally, the practical field can cross formal jurisdictional boundaries while remaining dependent on institutions that differ across those jurisdictions. Market-boundary analysis should therefore specify the mechanism of integration or segmentation rather than equate the relevant market with an administrative territory.

Proposition 12.58 (Market-boundary relativity). *The economically relevant boundary of a market field is relative to the object of exchange, substitution possibilities, institu-*

tional conditions, spatial and temporal scale, and the mechanism under investigation. Different defensible boundaries can therefore coexist for different analytical purposes.

12.13.10 Market Formation and Transformation

Markets form historically when sufficiently recurrent relations of participation, comparison, exchange, payment, information, recognition, and enforcement become available around an economically relevant class of objects or activities. Formation can involve legal change, technological innovation, organizational entrepreneurship, standardization, new infrastructures, new classifications, changing property relations, changes in mobility, or shifts in social practice. There is consequently no requirement that a market pre-exist the institutional and technological processes through which it becomes practically possible.

Transformation can modify any dimension of the field. New intermediaries can reorganize matching and visibility; new regulation can change entry, disclosure, or liability; technical standards can integrate or fragment participants; network effects can alter competitive dynamics; new information systems can change observability; financial innovation can change the objects being exchanged; and changes in expectations can reshape participation before formal institutions change. Market transformation can therefore be gradual, abrupt, local, or multiscale.

Polanyi's historical analysis is especially relevant here because it treats market organization as historically instituted and capable of reorganizing wider social relations (Polanyi 1944; Polanyi 1957). GRE adopts the historical lesson without assuming a single trajectory of market development. Market formation and transformation can take heterogeneous paths, and different market forms can coexist with organizations, commons, households, public institutions, networks, and other modes of economic coordination.

Market fields can also transform through their own representations. Price indices, ratings, classifications, forecasts, risk models, benchmarks, and platform metrics can become incorporated into participant behavior and institutional practice. Where such feedback is strong, the market representation becomes part of the relational field whose future behavior it helps condition. This possibility connects market analysis to the book's broader treatment of performative epistemic events while remaining an empirical hypothesis for each case.

Remark 12.59 (Markets as historically revisable analytical objects). A market field should be treated as a revisable analytical object. Changes in participation, substitutes, institutions, intermediation, technology, information, expectations, or scale can justify changing the field boundary or replacing a market-centered representation with another economic configuration better suited to the inquiry.

Markets, on this account, are relationally organized exchange fields whose prices, participants, information, expectations, competitive and cooperative relations, intermediaries, and boundaries can acquire substantial coordinating effects while remaining historically constituted and institutionally supported. This representation preserves the analytical power of market and price analysis while keeping visible the relations through which markets become possible, differentiated, and transformable. It also leaves conceptual space for economic forms in which exchange is embedded

within household, community, common, platform, infrastructural, or other relational arrangements.

12.14 Households, Communities, and Commons

Households, communities, and commons provide economically consequential forms of coordination whose internal logic cannot be inferred from market exchange, organizational hierarchy, or state administration alone. This section develops them as heterogeneous relational configurations through which care, provision, dependency, allocation, shared resources, rules, reciprocity, stewardship, and collective capacities can be organized. The objective is analytical rather than classificatory: GRE does not treat households, communities, or commons as a single “non-market” domain, and it does not presume that these forms are intrinsically cooperative, equitable, sustainable, or normatively preferable. The discussion instead identifies recurrent relational dimensions that can help reconstruct how such configurations operate under particular historical and institutional conditions. Table 12.16 summarizes the principal dimensions used in the section.

The three categories named in the section title overlap without being equivalent. A household can participate in several communities and depend on common resources; a community can contain many households without constituting a household; and a commons can be governed by a community whose membership, resource users, and legal owners only partially overlap. The relevant analytical boundary therefore depends on the mechanism under investigation. GRE treats these categories as revisable relational descriptions rather than as fixed natural units.

Definition 12.60 (Household, community, and commons configurations). Within the present framework, a *household configuration* is a historically situated arrangement through which some participants organize recurrent provision, care, residence, resource use, obligation, or support; a *community configuration* is an arrangement in which participants are connected through sufficiently recurrent membership, shared practice, identification, locality, institution, or mutual obligation for the relevant inquiry; and a *commons configuration* is an arrangement in which access to, use of, maintenance of, or claims over a shared resource are governed through relations among multiple participants. These descriptions are analytical and may overlap in a single empirical setting.

12.14.1 Household Membership

Household membership can be defined through co-residence, kinship, marriage or partnership, legal registration, pooled resources, caregiving, shared consumption, shared debt, mutual obligation, or other relations. These criteria need not identify the same set of persons. Someone can contribute resources without residing in the household, receive care while living elsewhere, retain formal membership after practical separation, or share a dwelling without participating in a common provision structure. Household analysis therefore benefits from specifying the membership dimension relevant to the question rather than assuming a single household boundary.

Table 12.16: Selected relational dimensions of households, communities, and commons

Dimension	Analytical object	Questions for relational analysis
Household membership	Co-residence, kinship, legal status, contribution, dependence, recognition	Who is treated as a member for which purposes, and how do effective participation and formal status differ?
Care relations	Attention, maintenance, bodily and emotional support, social reproduction	Who gives and receives care, under what expectations, and with what effects on capacity, time, and dependency?
Provision	Acquisition and organization of resources needed for recurrent life and activity	Which resources are provided, through which relations, and how are market, public, household, and community channels combined?
Dependency and support	Unequal need, capacity, access, and reliance	Which dependencies are temporary, structural, reciprocal, asymmetric, enabling, or constraining?
Internal allocation	Distribution of money, time, goods, space, labor, attention, and opportunities	Which rules, negotiations, claims, or power relations shape access within the configuration?
Shared resources	Resources used, maintained, or governed by multiple participants	What are the relevant resource characteristics, access rules, exclusion mechanisms, and appropriation conditions?
Community governance	Rules, norms, monitoring, sanctioning, representation, and dispute resolution	How are collective expectations produced, enacted, challenged, and revised?
Reciprocity	Repeated giving, support, recognition, or return across time	What counts as return, over which horizon, and how are asymmetry, memory, and expectation organized?
Stewardship	Maintenance, repair, preservation, regeneration, or transformation of shared resources	Who bears responsibility for maintenance, who can alter the resource, and whose future claims are represented?
Collective capacity	Capabilities generated through coordination, shared resources, knowledge, or mutual support	Which capacities exist because of the configuration, who can access them, and how are their benefits and burdens distributed?

This distinction is economically consequential because membership can affect claims on income, housing, time, care, inheritance, insurance, public benefits, taxation, credit, and decision authority. It can also shape exposure to the consequences of other members' decisions. A household centered only on co-residence may understate remittance relations, intergenerational support, translocal care, or obligations extending beyond the dwelling. Conversely, kinship alone may overstate practical coordination where finances, care, and daily provision are largely separate.

Feminist economic analysis has emphasized that household and family decisions are situated within broader structures of gender, age, class, and other constraints, in-

cluding the distribution of unpaid work and the costs of social reproduction (Folbre 1994). GRE adopts the analytical implication without presuming a universal household form: the internal distribution of capacity, obligation, voice, and dependency should be reconstructed for the configuration under study.

Remark 12.61 (Household boundaries as dimension-relative). Household membership for residence, care, income pooling, legal responsibility, inheritance, or emotional attachment can yield different boundaries. A household analysis should state which boundary is being used and why it is adequate to the mechanism under investigation.

12.14.2 Care Relations

Care relations concern activities and commitments through which persons or other living beings are maintained, supported, attended to, or enabled to continue functioning and developing. Care can include bodily assistance, supervision, emotional support, childrearing, eldercare, disability support, household maintenance, health-related assistance, and forms of attention that sustain everyday participation. Such relations can occur within households, paid employment, public services, communities, voluntary organizations, or mixed arrangements.

Care has economic significance because it can generate and preserve capabilities while consuming time, attention, material resources, and opportunities. It can also redistribute these burdens unevenly. England's review of care-work theory shows that care can be organized both inside households and through paid markets, with its valuation shaped by several competing mechanisms and interpretations (England 2005). Folbre similarly emphasizes the economic importance of caregiving responsibilities and the institutional distribution of those responsibilities (Folbre 2001).

GRE treats care neither as an intrinsically harmonious relation nor as reducible to a market service. A care relation can be supportive, reciprocal, professional, familial, obligatory, exploitative, or some combination depending on the configuration. The relevant analysis can distinguish the recipient's needs, the caregiver's capacities and constraints, the temporal intensity of care, possibilities for substitution or respite, recognition and compensation, and the institutional arrangements that condition the relation.

Care also illustrates why economic consequences cannot always be inferred from monetary flows. Unpaid care can materially affect labor-market participation, health, learning, household resilience, and future capabilities even when no price is recorded. Paid care, conversely, can remain embedded in trust, emotional expectations, professional norms, and asymmetries that are not exhausted by the wage relation.

12.14.3 Household Provision

Provision concerns the recurrent acquisition, production, organization, and maintenance of resources needed for household life and participation. Food, shelter, energy, clothing, transportation, health care, education, communication, care, security, and discretionary resources may be provided through wages, self-production, public ser-

vices, transfers, gifts, shared assets, credit, community support, or combinations of these channels.

A provision-centered view is useful because household command over resources is not identical to aggregate availability. Sen's entitlement analysis demonstrates the importance of examining the legally and institutionally mediated means through which people can command food and other resources, rather than inferring access directly from total supply (Sen 1981). In a broader capability-oriented formulation, effective opportunity depends on the interaction of resources with personal, social, and institutional conditions (Sen 1999).

Within GRE, provision is therefore represented as a relational process linking external income and entitlement structures to internal allocation, care, household production, and dependency. A household with similar monetary income to another may have different provision capacities because of health needs, housing conditions, debt, care burdens, public-service access, household size, geography, or unequal control over pooled resources. Provision analysis should consequently avoid treating household income as a complete representation of internal economic capability.

12.14.4 Dependency and Support Relations

Dependency refers to conditions in which a participant's access to resources, care, mobility, protection, recognition, or opportunities depends materially on another participant or configuration. Dependency can arise from childhood, illness, disability, age, temporary hardship, specialized knowledge, legal status, financial obligation, infrastructure, or the organization of work and care. It can also be produced by prior decisions that narrow alternatives.

Dependency has several possible relational forms. Some dependencies are expected and temporary; others are long-term. Some are reciprocal across different domains or time horizons, while others are strongly asymmetric. A person may depend on another for care while providing income, knowledge, emotional support, or future obligations in return. Apparent independence in one dimension can coexist with strong dependency in another.

The economic significance of dependency lies partly in how it redistributes bargaining position, time, exposure, and exit capacity. Formal equality among household members or community participants can coexist with practical differences in access to income, documentation, housing, transport, social networks, or care alternatives. GRE therefore treats dependency as a relational condition to be specified empirically rather than as a fixed personal attribute.

Support relations are analytically broader than dependency. Participants can provide resources, information, care, advocacy, guarantees, access, or emergency assistance without creating a persistent dependency relation. The distinction matters because the same support can expand another participant's future capabilities or, under different conditions, make continued participation increasingly contingent on a particular provider.

12.14.5 Internal Resource Allocation

Internal allocation concerns the distribution of money, goods, time, space, labor, care, attention, risk, and opportunities among participants within a household or community configuration. Allocation can occur through explicit rules, negotiation, custom, role expectations, seniority, need, contribution, bargaining power, emergency, or tacit routines. Several logics can operate simultaneously.

Household-level aggregates can obscure this internal distribution. Equal household income per capita, for example, does not establish equal control over expenditures, equal consumption, equal leisure, equal access to education, or equal exposure to unpaid work. For GRE, the appropriate unit of analysis therefore depends on the question: the household can be a useful entity for some mechanisms while requiring decomposition into internal positions for others.

Internal allocation can also be dynamic. Current allocation influences future capabilities through nutrition, education, health, rest, savings, debt, skill formation, and social participation. An allocation that appears small in a short-period budget can have larger historical consequences if it changes later options or dependencies. This generative effect is analytically distinct from a normative judgment about whether the allocation is fair.

Proposition 12.62 (Household-aggregate non-equivalence). *For questions concerning individual access, burden, capability, or decision authority, household-level resource aggregates are generally insufficient unless the relevant internal allocation mechanism is shown to make the aggregate an adequate proxy for the positions being analyzed.*

12.14.6 Shared Resources and Common-Pool Arrangements

Shared resources are resources whose use, maintenance, access, or value involves multiple participants. They can include land, water, fisheries, forests, irrigation systems, shared housing facilities, knowledge repositories, digital infrastructure, community funds, equipment, or other resources whose economically relevant characteristics depend on collective use or governance. Different shared resources create different problems of exclusion, congestion, depletion, maintenance, and contribution.

Commons analysis requires an especially important distinction between a *resource* and the *institutional arrangement* governing it. The influential tragedy-of-the-commons model describes one possible dynamic of unregulated appropriation from a shared resource (Hardin 1968). Subsequent empirical institutional research has documented a wider range of self-organized common-pool-resource arrangements, including durable governance systems as well as failures (Ostrom 1990). GRE therefore avoids treating “commons” as synonymous with open access or with a single governance form.

A commons configuration can involve rules concerning eligibility, appropriation, contribution, monitoring, sanctions, dispute resolution, maintenance, modification, and succession. These arrangements may be formal or informal and can interact with state law, markets, organizations, households, and technologies. The economically

relevant object is consequently the resource together with the relational architecture through which participants access, use, reproduce, or transform it.

Commons can also extend beyond natural resources. Knowledge commons, for example, raise questions of access, enclosure, preservation, intellectual property, contribution, and governance while differing materially from subtractable natural-resource systems (Hess and Ostrom 2007). Similar vocabulary should therefore be transferred across resource types only after the relevant mechanisms have been specified.

Caution 12.63 (Commons and open access). A shared resource should not be described as a commons merely because multiple people can access it. Commons analysis requires attention to the relations and rules through which access, use, contribution, maintenance, and conflict are organized. Open access is one possible configuration among others.

12.14.7 Community Rules and Governance

Community governance concerns the recurrent rules, norms, roles, expectations, monitoring practices, representations, and dispute-resolution arrangements through which participants coordinate shared activities or resources. A community need not possess a unified constitution or formal government. Governance can be distributed across customary practices, associations, committees, elders, technical systems, local organizations, public agencies, or overlapping institutional arrangements.

Ostrom's institutional work emphasizes that rules used by participants, community attributes, and action situations jointly shape patterns of interaction and outcomes (Ostrom 2005). This supports a relational treatment in which community rules acquire significance through enactment rather than through textual existence alone. A nominal rule can remain weak if participants lack information, legitimacy, monitoring capacity, or feasible enforcement; an informal rule can be highly consequential when it structures expectations and recurrent behavior.

Community rules can govern access, contribution, timing, maintenance, representation, sanctioning, information sharing, membership, conflict resolution, and the amendment of the rules themselves. They can also distribute authority unevenly. Analysis should therefore examine who can participate in rule formation, who can interpret or enforce rules, who bears their costs, and which members or affected outsiders possess avenues for contestation.

The presence of community governance carries no automatic normative conclusion. Local rules can sustain shared capacities and mutual support, but they can also reproduce exclusion, hierarchy, or burdens that are difficult for some participants to challenge. GRE treats governance performance and normative evaluation as separate questions requiring explicit criteria.

12.14.8 Reciprocity Relations

Reciprocity concerns relations in which present acts are connected to remembered, expected, or normatively salient acts of return across time. Return need not take the same form as the original contribution. Material assistance can be answered by care,

information, labor, protection, future help, recognition, or participation in collective tasks. Reciprocity can therefore operate through heterogeneous value forms and long time horizons.

Ostrom's behavioral analysis of collective action identifies reciprocity, reputation, and trust as important mechanisms through which participants can sustain cooperation in repeated social dilemmas (Ostrom 1998). GRE treats these mechanisms as empirically contingent relational processes rather than as universal motivations. Their operation can depend on observability, memory, group structure, exit possibilities, power, institutional rules, and shared interpretations of what counts as an adequate return.

Reciprocity should also be distinguished from exact equivalence. Participants may accept asymmetric contributions because needs, capacities, timing, or roles differ. Conversely, an apparently reciprocal relation can conceal coercive expectations where participants cannot realistically refuse, exit, or renegotiate obligations. A relational analysis therefore examines how obligations are remembered and interpreted, who defines adequate return, and how differences in power affect the meaning of reciprocity.

12.14.9 Resource Stewardship

Stewardship concerns activities through which participants maintain, repair, preserve, regenerate, monitor, or deliberately transform resources whose future condition matters to the configuration. The concept can apply to land, water, buildings, infrastructures, knowledge, archives, community funds, ecosystems, technical systems, or other shared resources. It directs attention to temporal relations between present use and future capacity.

Stewardship should remain analytically separate from preservation. Maintaining a resource can require change: repair, ecological restoration, technological replacement, institutional redesign, or changes in access rules. In other cases, continued preservation of an inherited arrangement may impose costs on current participants or protect a configuration that has lost its practical justification. The relevant inquiry is therefore which resource qualities or capacities are being maintained, for whom, over which horizon, and through which obligations and authorities.

Research on social-ecological systems illustrates the value of analyzing resource systems, resource units, governance systems, users, interactions, and outcomes together rather than isolating one dimension (Ostrom 2009). GRE draws on this systems lesson while retaining scope discipline: stewardship of a shared economic resource should be specified through the concrete mechanisms of access, maintenance, regeneration, monitoring, and transformation relevant to the case.

Stewardship can also distribute burdens unevenly across time. Current participants may bear maintenance costs that benefit future participants, while future costs can be generated by present extraction or underinvestment. Such temporal distribution raises normative questions, but GRE does not infer one universal stewardship principle. The first task is to make the intertemporal relational structure visible enough for evaluation under the relevant commitments.

12.14.10 Collective Capacity

Household, community, and commons configurations can generate capacities that are unavailable, more costly, or less reliable when participants act separately. Shared childcare, pooled savings, collective purchasing, mutual insurance, common infrastructure, shared knowledge, coordinated maintenance, emergency support, and joint governance can expand what participants are able to do. Such capacities can arise through complementarity, specialization, trust, repeated interaction, resource pooling, or institutionalized cooperation.

Collective capacity should be distinguished from equal access to that capacity. A community may possess a shared facility while some members face practical barriers to using it; a household may hold assets that one member cannot control; a commons may support productive activity while benefits are unevenly distributed. The existence of a collective capacity therefore establishes neither equal participation nor normative desirability.

The same configuration can also generate vulnerability. Resource pooling can increase resilience to some shocks while creating exposure to common failure; dense mutual support can reduce individual risk while making exit costly; strong community governance can coordinate maintenance while concentrating interpretive authority. GRE therefore treats collective capacity as one relational property among others, to be analyzed together with access, control, dependency, distribution, and revision.

Proposition 12.64 (Configuration-dependent collective capacity). *A collective capacity can be attributed to a household, community, or commons configuration when an identifiable relational mechanism makes the relevant capability depend materially on coordination, shared resources, complementary roles, common knowledge, or recurrent support within that configuration. Attribution of the capacity does not determine how access, control, burdens, or benefits are distributed among participants.*

Households, communities, and commons thus broaden the relational architecture of economic systems beyond exchange-centered representations without constituting a unified alternative to markets or organizations. Their economic significance can arise through membership, care, provision, dependency, allocation, shared resources, governance, reciprocity, stewardship, and collective capacity in combinations that vary across history and context. Treating these configurations as internally heterogeneous and externally connected prepares later analysis of platforms, infrastructures, resources, access, ownership, labor, coordination, asymmetry, and generative potential without assigning one institutional form a privileged normative status.

12.15 Platforms and Infrastructures

Platforms and infrastructures organize economic relations by shaping the conditions under which participants can connect, transact, coordinate, observe, interoperate, and build further activities. This section develops platforms and infrastructures as related but non-equivalent components of economic architecture. Its objective is to identify the relational mechanisms through which mediation, access, standards,

interoperability, dependency, gatekeeping, network effects, and infrastructural change can condition later economic possibilities. The discussion remains architectural rather than sector-specific: digital platforms are important examples, but the framework also applies to non-digital exchanges, payment and logistics systems, communication networks, standards regimes, shared facilities, public infrastructures, and other arrangements where recurrent economic activity depends on common interfaces or enabling resources. Table 12.17 summarizes the dimensions used in the section.

Economic analysis of platforms has emphasized configurations in which participation on one side affects participation or value on another, making the organization of access and price structure important to the viability of the mediating system (Rochet and Tirole 2003). Research on systems competition likewise shows that compatibility and network effects can make adoption interdependent across users and technologies (Katz and Shapiro 1994). Infrastructure analysis adds a different emphasis: shared resources can serve as inputs into heterogeneous downstream activities, so access and governance conditions can influence a wide range of later productive and social uses (Frischmann 2012). GRE uses these literatures as complementary sources for relational reconstruction. A platform can mediate interactions without becoming infrastructure for every participant, and an infrastructure can enable many activities without organizing them through a platform-like relation.

Definition 12.65 (Platform-mediated architecture and infrastructural condition). For a specified economic inquiry, a *platform-mediated architecture* is a configuration in which a mediating entity, protocol, organization, or technical-institutional arrangement recurrently conditions interactions among two or more participant positions through access rules, interfaces, matching, ordering, standards, records, or governance. An *infrastructural condition* is a comparatively persistent material, technical, institutional, informational, or organizational arrangement on which heterogeneous downstream activities recurrently depend. Either form can overlap with the other, and neither description implies a fixed ontological category.

Definition 12.65 is deliberately functional and historical. The same empirical arrangement can be platform-like for one process and infrastructural for another. A payment network can mediate transactions among participants while simultaneously functioning as a shared infrastructural input to businesses that build additional services upon it. Conversely, a road, legal registry, technical standard, or communications backbone can condition economic action without performing the matching, ranking, or multi-sided coordination usually associated with platform mediation.

Proposition 12.66 (Platform–infrastructure non-equivalence). *Platform mediation and infrastructural conditioning identify different relational roles. Their empirical overlap should be established through the mechanisms of mediation, dependence, shared use, access, and governance relevant to the inquiry rather than inferred from a label such as “platform,” “network,” or “infrastructure.”*

12.15.1 Platform-Mediated Relations

Platform-mediated relations arise when an intermediary configuration recurrently conditions how distinct participant positions encounter, evaluate, transact with, or

Table 12.17: Selected relational dimensions of platforms and infrastructures.

Dimension	Relational object	Illustrative analytical questions
Platform mediation	Interfaces, matching, ranking, settlement, participation rules, records, and governance connecting participant positions	Which interactions are mediated, through which mechanisms, and which decisions remain with participants or the mediator?
Infrastructure	Shared material, technical, institutional, informational, or organizational conditions supporting recurrent downstream activity	Which activities depend on the arrangement, and which parts of the condition are shared, substitutable, or difficult to replace?
Access	Eligibility, connectivity, discoverability, technical capability, transactional capacity, and redress	Who can practically use the platform or infrastructure, at which layer, and under which conditions?
Standards	Rules for formats, categories, interfaces, measurement, identification, quality, or protocol	Which forms of coordination do standards enable, and which actors bear adaptation or compliance costs?
Interoperability	Ability of heterogeneous systems, organizations, records, or participants to interact across boundaries	Which layers interoperate, with what translation, and does interoperability imply portability or substitutability?
Dependency	Reliance on access, interfaces, data, standards, coordination, or complementary resources	Which capacities become difficult to exercise when the arrangement changes or access is lost?
Gatekeeping	Control over entry, visibility, ranking, compatibility, certification, transaction channels, or rule interpretation	Which positions can condition participation and on what basis can those conditions be reviewed or changed?
Network effects	Changes in value or feasible interaction associated with adoption or participation by others	Which effects are direct, indirect, local, cross-side, or contingent on compatibility and complementary resources?
Transformation	Change in architecture, governance, standards, interfaces, scale, boundaries, or dependency structure	Which historical processes expand, integrate, fragment, modularize, replace, or repurpose the arrangement?

otherwise act in relation to one another. The mediating mechanism can include search, matching, ordering, ranking, identity verification, payment, settlement, reputation, scheduling, data exchange, technical interfaces, dispute resolution, or rule enforcement. A platform therefore need not be understood solely as a digital marketplace. The analytical category concerns the recurrent mediation of relations through a shared architecture.

Rochet and Tirole's analysis of two-sided markets demonstrates one important mechanism: participation or surplus on one side can depend on participation on another, so a platform's price structure and participation rules can influence whether the interaction system is viable (Rochet and Tirole 2003). GRE generalizes the relational lesson cautiously. Different platform configurations can connect more than two participant positions, can rely on non-price conditions as well as prices, and can

organize relations whose primary object is coordination, communication, logistics, identity, information, or technical compatibility rather than exchange alone.

A platform-mediated relation can therefore be represented at several levels. At the interaction level, the platform changes who can encounter whom and under which conditions. At the organizational level, it can allocate roles among users, providers, complementors, moderators, certifiers, or other participants. At the institutional level, its rules can classify conduct, define eligibility, specify dispute processes, or determine what records count as authoritative within the mediated environment. These levels can be analytically separated even when they are implemented within one organization or technical system.

Platform mediation also has an endogenous character. Participant behavior can change the information, rankings, queues, inventories, reputational records, or other states on which later mediation depends. The platform can consequently participate in a feedback process in which earlier interactions alter the conditions of later interactions. The importance of this feedback is an empirical question. In some systems it is central to participation and visibility; in others, the platform is closer to a relatively stable conduit.

Remark 12.67 (Mediation without total control). A mediating position can be economically consequential without controlling every action that occurs through it. Platform analysis should distinguish the conditions the mediator can set or modify from decisions, resources, obligations, and capabilities that remain distributed among participants and external institutions.

12.15.2 Infrastructure as a Relational Condition

Infrastructure becomes economically relevant when recurrent activity depends on comparatively persistent shared conditions. These conditions can be material, such as transport, energy, water, storage, or communication systems; technical, such as protocols or computing services; institutional, such as registries, payment arrangements, identification systems, or legal procedures; and informational, such as common classifications, records, or reference systems. The category is relational because an arrangement becomes infrastructural through the activities it enables and the dependencies it supports, not merely through its physical form.

Frischmann's demand-side account emphasizes infrastructure as a shared input capable of supporting heterogeneous downstream uses (Frischmann 2012). This perspective is useful for GRE because it shifts attention from the infrastructure object alone to the plurality of capacities and activities made possible through access to it. A communications network, public database, port, standard, or road system can matter economically through uses that its designers did not fully specify in advance. The same infrastructure can therefore participate in several sectors, organizations, communities, and scales simultaneously.

An infrastructural condition can also remain partially invisible during routine operation. Participants may experience the service or capability it supports without reconstructing the material maintenance, standards, labor, institutional authority, finance, monitoring, and repair required for its persistence. Disruption can reveal these dependencies by making previously background conditions practically salient.

This does not mean that infrastructure is causally inactive when it is unnoticed. Its stabilizing effects can be strongest precisely when recurrent activity is able to proceed without continuous renegotiation of underlying conditions.

The infrastructural description should nevertheless remain selective. Treating every background condition as infrastructure would remove analytical discrimination. GRE therefore asks whether the condition supports sufficiently recurrent and heterogeneous downstream activity, whether its continuity or failure materially changes relevant capacities, and whether the shared dependency contributes explanatory content that would be missed by representing each downstream relation separately.

Remark 12.68 (Infrastructural relevance). Infrastructure is a role assigned relative to an inquiry and a set of downstream activities. The same arrangement can be infrastructural for one process, merely complementary for another, and irrelevant for a third. The attribution should identify the dependency mechanism and the scale at which it operates.

12.15.3 Platform and Infrastructure Access

Access concerns the practical capacity to use, reach, or benefit from a platform or infrastructure under relevant conditions. Formal permission is only one component. Effective access can depend on connectivity, identity or eligibility, physical proximity, technical compatibility, language, price, credit, device or equipment availability, knowledge, time, visibility, organizational status, data rights, or the availability of complementary resources. Access can consequently differ substantially among participants even where nominal terms are uniform.

For platform-mediated architectures, access is often layered. One participant may be able to create an account but lack meaningful visibility; another may transact but lack access to relevant records or interfaces; a complementor may reach users but depend on approval for software interfaces; a seller may participate but face settlement delays that materially constrain working capital. Infrastructure access is similarly differentiated. Physical connection can coexist with unreliable service, insufficient capacity, prohibitive cost, weak legal entitlement, or the absence of complementary capabilities needed to make productive use of the connection.

This suggests that access should be reconstructed as a bundle of relations and capacities rather than a binary state. Relevant dimensions can include entry, connectivity, discovery, use, contribution, modification, data retrieval, interoperability, redress, portability, and exit. The importance of each dimension depends on the architecture and inquiry. A platform that mediates communication and a transport infrastructure may require very different access profiles even when both are widely available.

Proposition 12.69 (Layered access). *Access to platforms and infrastructures can be differentiated across eligibility, connectivity, visibility, technical capability, transactional capacity, information, redress, portability, and exit. Formal admission therefore provides incomplete evidence of effective economic access when other layers materially condition participation or use.*

Access can also be dynamically produced. Standards, pricing, subsidies, organiza-

tional support, training, new interfaces, interoperability arrangements, or changes in complementary infrastructure can expand practical access without altering formal membership rules. Conversely, technical change or revised standards can reduce effective access even when formal eligibility remains unchanged. This dynamic aspect becomes important when evaluating infrastructure transformation later in the section.

12.15.4 Standards and Interface Rules

Standards coordinate expectations concerning formats, identities, measurement, interfaces, quality, compatibility, safety, reporting, or procedure. They can reduce the need for repeated bilateral negotiation by establishing shared conditions under which heterogeneous participants or systems can interact. In platform and infrastructure settings, standards can shape which components connect, which records are recognized, which transactions can be processed, and which forms of evidence or performance become legible.

Classification and standardization also select what is represented. Bowker and Star show that standards and classification systems are embedded in information infrastructures and can shape visibility, categories, and interaction (Bowker and Star 1999). The relevant implication for GRE is not that standardization is intrinsically problematic. Standards can support large-scale coordination, interoperability, safety, comparability, and reliability. Their analytical significance lies in the way a standard simultaneously enables some relations and imposes adaptation, translation, exclusion, or maintenance requirements on others.

Standards can be public, private, professional, organizational, technical, legal, or hybrid. Their authority can derive from law, contractual adoption, technical necessity, installed use, procurement rules, professional recognition, market convention, or coordination among participants. A standard can therefore become practically binding without being legally mandatory, while a legally specified standard can have limited practical effect if implementation, monitoring, or complementary infrastructure is weak.

Interface rules are a particularly important subset because they govern the points at which participants or components interact with the architecture. Application programming interfaces, document formats, payment interfaces, identification protocols, logistical specifications, reporting schemas, and contractual procedures can all condition who can connect and what actions can be performed. Changes to interface rules can consequently redistribute adaptation costs, create new opportunities, or render earlier investments less useful.

Remark 12.70 (Standards as enabling and selective). A standard can expand coordination while simultaneously selecting categories, imposing adaptation costs, or privileging particular technical and organizational arrangements. Evaluation should therefore distinguish the coordination capacity generated by standardization from the distribution of costs, access, and control associated with the standard.

12.15.5 Interoperability Relations

Interoperability concerns the capacity of heterogeneous systems, organizations, records, or participants to interact across a relevant boundary. It can be technical, semantic, organizational, institutional, or procedural. Two systems may exchange data while interpreting categories differently; two organizations may share standards while lacking procedures for recognizing one another's decisions; two payment systems may be technically connectable while legal or contractual restrictions prevent practical use. Interoperability should therefore be specified by layer rather than treated as a single property.

Systems competition research shows that compatibility can affect adoption incentives and competitive dynamics when users benefit from connection to a wider installed base (Katz and Shapiro 1994). Within GRE, compatibility is one possible mechanism of interoperability, but the concepts are not identical. Compatibility can describe whether components can function together, whereas interoperability may additionally require translation, recognition, governance, and operational procedures across organizational or institutional boundaries.

Interoperability can expand feasible relations by reducing switching, translation, or coordination burdens. It can allow participants to combine complementary systems, move records, reach additional counterparties, or preserve some capabilities when changing providers. Yet interoperability can also create new dependencies on shared standards, translation layers, certifiers, identity systems, or governance arrangements. The relevant question is therefore which relations become possible, which new control points are introduced, and how costs and responsibilities are distributed across the interoperating architecture.

Interoperability also differs from substitutability. Two systems can interoperate while serving different functions, and two substitutable systems can remain poorly interoperable. The distinction matters for dependency analysis. A participant may retain access to several interoperable services without possessing a realistic substitute for a particular infrastructural function.

Caution 12.71 (Interoperability and substitutability). Interoperability should not be used as evidence of substitutability without additional mechanism-specific support. The ability of systems to exchange information or coordinate operations does not establish that participants can replace one system with another at comparable cost, quality, legal standing, or functional scope.

12.15.6 Infrastructural Dependency

Dependency arises when a participant's capacities become contingent on continued access to, compatibility with, or support from a platform or infrastructure that is difficult to replace within the relevant horizon. The dependency can concern resources, connectivity, coordination, knowledge, identity, reputation, records, payment, technical capability, market access, or institutional recognition. It can be mutual, asymmetric, temporary, or historically cumulative.

Infrastructural dependency often develops gradually. Organizations can redesign workflows around a shared system, participants can accumulate records or reputa-

tion within one architecture, complementary investments can become specific to a standard, and counterparties can coordinate expectations around a common interface. Increasing returns and historically contingent adoption can make later switching more costly or less attractive than earlier switching, even when alternative technologies remain technically possible (Arthur 1989). Such path dependence is one possible mechanism rather than a universal outcome of infrastructure use.

Dependency should be distinguished from simple use frequency. A frequently used platform may be readily replaceable, whereas a rarely used infrastructural service can be indispensable during a critical event. GRE therefore reconstructs dependency through counterfactual capacity: what relevant activities, options, or relations become unavailable, delayed, more costly, or institutionally invalid if access changes? The answer can differ across participants because complementary resources and alternatives are unevenly distributed.

Dependency can also be distributed across layers. A business can avoid dependence on a particular application while remaining dependent on a payment network, identity system, technical standard, cloud layer, logistics system, or regulatory registry. Architecture-level analysis can therefore reveal dependencies that are obscured when attention is restricted to the most visible platform interface.

Remark 12.72 (Dependency as capacity contingency). The present framework treats infrastructural dependency as a relation between continued access to an architecture and the preservation of specified capacities over a stated horizon. Dependency does not by itself establish exploitation, domination, inefficiency, or normative undesirability; those assessments require additional institutional, distributive, and normative analysis.

12.15.7 Gatekeeping and Access Control

Gatekeeping concerns positions that can condition entry, visibility, ranking, certification, compatibility, transaction, interface access, or continued participation in a platform or infrastructure. The gatekeeper can be an organization, administrator, technical protocol, professional body, regulator, standards organization, automated system, or combination of these. Gatekeeping is therefore a relational position defined by control over a consequential passage or condition, not by a particular organizational label.

Gatekeeping can serve several functions. Access controls can protect security, reliability, privacy, quality, safety, or resource integrity; certification can reduce information burdens; moderation can preserve usable interaction; and capacity allocation can prevent congestion or failure. These functions can coexist with substantial authority over who participates and under which conditions. The analytical task is to reconstruct both the capacity generated by gatekeeping and the dependencies, discretion, review mechanisms, and distributional effects associated with it.

Control can also be indirect. A platform can shape visibility through ranking rules without excluding participants formally. An infrastructure operator can alter compatibility requirements in ways that change participation costs. A standards body can determine which formats become recognizable. A payment intermediary can condition settlement without controlling the underlying sale. These cases demon-

strate why access control cannot be inferred solely from ownership of the exchanged or transported object.

Gatekeeping becomes especially consequential where alternative routes are weak, switching costs are high, or the gated position controls a shared standard or infrastructure used by many downstream actors. The position can then affect the practical action space of participants even if individual transactions remain voluntary. Where relevant, analysis should identify how gatekeeping decisions are made, communicated, appealed, monitored, and revised.

Proposition 12.73 (Gatekeeping as relational control). *A gatekeeping position exists when an actor or mechanism can materially condition access to a consequential relation, interface, standard, visibility channel, or infrastructural capacity. The economic significance of that position depends on the importance of the gated capacity, the availability of alternatives, the distribution of switching costs, and the governance of gatekeeping decisions.*

12.15.8 Network Effects and Cumulative Adoption

Network effects arise when the value, usefulness, or feasible interaction associated with a product, service, standard, or platform depends partly on adoption or participation by others. The mechanism can be direct, where users benefit from interacting with additional users of a compatible system, or indirect, where participation on one side changes the availability of complements, counterparties, services, or participation on another side. Katz and Shapiro analyze these mechanisms in systems markets, while Rochet and Tirole develop related cross-side effects in two-sided platform competition (Katz and Shapiro 1994; Rochet and Tirole 2003).

GRE treats network effects as mechanism-specific relational effects rather than a general property of networks. A network can exist without economically significant network effects, and network effects can vary by participant position, location, scale, quality, congestion, compatibility, or time. Additional participation can increase value for some actors while producing congestion, competition, moderation burdens, privacy costs, or reduced visibility for others. The sign and magnitude of the effect should therefore be established empirically for the relevant relation.

Cumulative adoption can interact with standards and dependency. An installed base can attract complementary investment, learning, service provision, or further users, while the resulting ecosystem can make alternative architectures less attractive or more costly to adopt. Arthur's analysis of increasing returns and historical lock-in provides one mechanism through which early events can shape later technology selection (Arthur 1989). GRE retains the historical insight while avoiding a presumption that lock-in necessarily follows. Multi-homing, interoperability, modularity, regulation, new standards, falling switching costs, or technological discontinuity can weaken cumulative advantage.

Network effects can also operate across layers of the architecture. The relevant object may be the user network, a complement ecosystem, a technical standard, an identity system, a payment network, or a body of interoperable records. Identifying the layer matters because interventions that change one network effect may leave another intact. A requirement for data portability, for example, may reduce one switch-

ing cost while leaving reputation, complement availability, technical integration, or participant expectations largely unchanged.

Remark 12.74 (Network effects as situated mechanisms). Network effects should be specified by participant position, mechanism, scale, and horizon. Their presence does not by itself establish monopoly, efficiency, welfare improvement, lock-in, or a particular policy conclusion.

12.15.9 Infrastructure Transformation

Platforms and infrastructures transform when their material components, standards, interfaces, governance, participant roles, access conditions, scale, or dependencies change sufficiently to alter the relations they support. Transformation can involve expansion, integration, fragmentation, modularization, replacement, repurposing, standard migration, organizational restructuring, public or private governance changes, or the emergence of new layers between participants and earlier infrastructure. The relevant unit of change should be defined by the mechanism under study rather than by assuming that an infrastructure transforms only when its physical assets are replaced.

Transformation can be path dependent because existing standards, installed equipment, organizational routines, records, complementary investments, and participant expectations condition which alternatives are feasible at a given time. It can also be discontinuous. A new technical interface, legal rule, organizational intermediary, or cross-system standard can reorganize access and dependency even when much of the physical infrastructure remains unchanged. Conversely, substantial investment in physical capacity may leave relational architecture largely intact if rules, access, and control remain stable.

Digital technologies illustrate how changes in search, replication, transportation, tracking, and verification costs can reorganize economic coordination (Goldfarb and Tucker 2019). The broader GRE point is technological rather than digital-essentialist: when the cost or feasibility of observing, connecting, copying, verifying, or coordinating changes, earlier relational boundaries and organizational forms can become less stable. Whether that change produces decentralization, concentration, new intermediaries, wider access, or new dependency remains an empirical question.

Transformation can also alter the status of an arrangement. A platform initially used for a narrow set of interactions can acquire infrastructural characteristics if heterogeneous downstream activities reorganize around its interfaces and continuity. An infrastructure can become more platform-like if access, matching, ranking, identity, and transaction governance are increasingly concentrated in a mediating layer. These are historical shifts in relational role rather than categorical conversions that can be inferred from terminology alone.

Proposition 12.75 (Relational transformation of infrastructural role). *An arrangement's platform or infrastructural role can change when the relations of mediation, shared use, dependency, standards, access, or governance through which downstream activities are organized change materially. The attribution should therefore be revisable across historical periods and analytical scales.*

Infrastructure transformation can generate both new capacities and new constraints. Interoperability can widen participation while creating reliance on common standards; integrated systems can reduce coordination burdens while increasing correlated failure or shared dependency; modular architectures can expand experimentation while shifting responsibility to interface governance; and new access channels can extend participation while generating additional gatekeeping positions. GRE therefore evaluates infrastructural change through the relational configuration it produces rather than through a general presumption that greater connectivity, standardization, integration, or scale is intrinsically preferable.

Platforms and infrastructures, on this account, are parts of economic architecture through which relations become connectable, repeatable, scalable, observable, and sometimes difficult to replace. Their economic significance arises from mediation, shared use, access, standards, interoperability, dependency, gatekeeping, network effects, and historical transformation. These dimensions also prepare the analysis of resources, capacities, constraints, and access by showing that what an economic subject can possess or do often depends on relational conditions that lie outside the subject itself.

12.16 Resources

Resources occupy a central place in economic description because production, provision, exchange, care, learning, mobility, organizational action, and institutional participation depend on conditions that can be mobilized for practical purposes. This section develops a Generative Relational account of resources as historically situated and relation-dependent economic objects. Its objective is to distinguish important resource forms while avoiding the assumption that resources are self-identifying stocks whose economic significance is independent of subjects, institutions, access conditions, technologies, or purposes. The discussion proceeds through material, financial, temporal, spatial, informational, knowledge, attentional, infrastructural, institutional-access, and relational resources before examining resource convertibility. The method is conceptual and comparative: each resource form is characterized by the relations that make it usable and by the conditions under which apparent possession differs from effective mobilization. Table 12.18 summarizes the distinctions used in the section.

The distinction between aggregate availability and effective command over resources is well established in economic analysis. Sen's entitlement approach, for example, shows that aggregate food availability does not determine whether particular persons can command food through production, exchange, transfers, or legally recognized entitlements (Sen 1981). The capability approach further distinguishes possession of commodities or means from what persons are actually able to do or be with them, drawing attention to heterogeneous conversion conditions (Sen 1985; Robeyns 2005). GRE adopts the broader relational lesson without treating the capability framework as identical to GRE: the economic significance of a resource depends partly on the configuration through which it becomes accessible and convertible into relevant capacities.

Definition 12.76 (Economic resource). For a specified economic inquiry, an *economic resource* is a material, financial, temporal, spatial, informational, epistemic, attentional, infrastructural, institutional, or relational condition that a subject or configuration can potentially mobilize in forming, sustaining, transforming, or exercising an economically relevant capacity. Resource attribution is relative to the relevant subject, process, historical conditions, and mechanisms of access and use.

Definition 12.76 treats resourcehood as relational without making it purely subjective. A physical asset, monetary balance, database, transport system, credential, professional relation, or period of available time can exist independently of a particular intended use, yet its economic significance changes with access, compatibility, institutions, knowledge, timing, and complementary conditions. The same object can therefore function as a resource for one process while remaining unusable, inaccessible, or even constraining for another.

Proposition 12.77 (Relational resource attribution). *Resource attribution should identify both the object or condition being treated as a resource and the relational mechanism through which it can contribute to a specified capacity or process. Possession, availability, recognition, and effective mobilization may diverge.*

12.16.1 Material Resources

Material resources include physical and biological conditions that can enter economic activity as inputs, means of provision, productive equipment, energy, land, buildings, inventories, raw materials, ecological stocks, or other materially consequential objects. Their resource character depends on more than physical existence. A mineral deposit can be geologically present without being economically usable under available technology, law, infrastructure, energy conditions, knowledge, or cost structures. Equipment can be owned but unusable because complementary components, maintenance, trained operators, or electricity are absent. Food can exist in aggregate while particular households lack command over it, as entitlement analysis demonstrates (Sen 1981).

The relevant material description therefore depends on the process under study. Mass, energy content, durability, location, divisibility, quality, perishability, substitutability, toxicity, renewability, and compatibility can matter differently across activities. GRE does not require a universal material-resource taxonomy. It asks which material properties enter the relational mechanism under investigation and which complementary relations make those properties economically consequential.

Material resources also possess histories. Infrastructure degrades, inventories turn over, soil quality changes, machinery accumulates wear, and biological resources reproduce or decline. Investment, maintenance, repair, extraction, pollution, replenishment, and technical redesign can therefore alter future resource conditions. A static inventory can be informative for a particular question while remaining insufficient for problems in which maintenance, depletion, reproduction, or cumulative environmental change matters.

The boundary of a material resource may itself be contested or scale-dependent. A factory can be treated as a productive asset at one resolution, decomposed into machines and technical systems at another, and embedded within energy, logistics, la-

Table 12.18: Selected resource forms and their relational conditions.

Resource form	Illustrative economic object	Relational conditions requiring analysis
Material	Land, energy, equipment, biological materials, inventories, physical inputs	Access, quality, location, compatibility, maintenance, depletion, substitution, and rights of use
Financial	Money balances, liquid claims, credit lines, securities, borrowing capacity	Liquidity, denomination, settlement, collateral, creditworthiness, legal claims, and market access
Temporal	Available time, scheduling windows, waiting capacity, sequencing flexibility	Obligations, deadlines, synchronization, care burdens, institutional calendars, and delay
Spatial	Location, proximity, territorial position, physical reach, logistical placement	Transport, jurisdiction, accessibility, connectivity, congestion, and spatial exclusion
Informational	Data, signals, records, measurements, forecasts, classifications	Observability, quality, timeliness, interpretation, rights, provenance, and performative effects
Knowledge	Skills, know-how, theories, procedures, tacit understanding, organizational competence	Learning, embodiment, codification, transfer, interpretation, retention, and complementary experience
Attentional	Cognitive and organizational capacity to notice, select, interpret, and follow information	Information load, priorities, interruption, expertise, organizational allocation, and time
Infrastructural	Shared technical, material, organizational, or institutional support conditions	Access, standards, interoperability, continuity, dependency, governance, and maintenance
Institutional-access	Eligibility, recognized status, licences, credentials, procedural standing, entitlements	Classification, documentation, authority, enforcement, procedural access, and contestability
Relational	Trust, reputation, obligations, network position, reciprocal ties, cooperative histories	Recognition, maintenance, reciprocity, asymmetry, closure, brokerage, and institutional context
Convertibility	Capacity to transform one resource configuration into another economically relevant form	Conversion mechanism, loss, delay, asymmetry, complementarity, reversibility, and historical conditions

bor, and ecological infrastructures at a wider scale. The appropriate boundary should follow the causal and practical question rather than the convenience of an accounting category alone.

12.16.2 Financial Resources

Financial resources consist of monetary balances, liquid claims, credit capacities, financial assets, borrowing arrangements, payment instruments, and other financially

recognized positions that can support transactions, investment, buffering, or commitments. Their practical relevance depends on denomination, liquidity, settlement infrastructure, legal enforceability, collateral, creditworthiness, transaction costs, market conditions, and institutional recognition. A nominal monetary amount therefore does not by itself describe the economic capacities that the holder can exercise.

Financial resources can differ sharply in temporal and relational structure. Cash or immediately spendable deposits can support short-horizon commitments; an illiquid claim may represent substantial wealth while offering limited capacity to meet an urgent payment; a credit line can expand present action possibilities while generating future obligations; collateralized borrowing can transform ownership of one resource into conditional access to another. Financial resource analysis should therefore distinguish the value recorded in an account from the practical capacities available under the relevant institutional and market conditions.

Financial relations can also couple actors across time. Credit creates present access through claims on future repayment, while securities, insurance arrangements, pensions, and other contracts distribute claims, risks, and obligations across future events. These relations make finance especially sensitive to expectations, legal enforceability, counterparty conditions, and institutional continuity. The same contractual claim can therefore change in practical significance as confidence, regulation, market liquidity, or the position of counterparties changes.

GRE treats financial resources as one resource family among others. Financial means can purchase or mobilize many resources under some conditions, but monetary command does not create universal convertibility. Legal restrictions, scarcity, time, location, social relations, technical incompatibility, ecological limits, or unavailable knowledge can block financial substitution. This point becomes central in the discussion of resource convertibility in Subsection 12.16.11.

12.16.3 Temporal Resources

Time becomes an economic resource when the availability, sequence, duration, or flexibility of action conditions what a subject or configuration can practically do. Temporal resources include discretionary time, scheduling flexibility, response windows, waiting capacity, recovery periods, synchronization opportunities, and the ability to defer or accelerate commitments. These forms should be distinguished from clock time as a neutral coordinate. Two actors can possess the same number of hours while facing very different temporal resources because their obligations, deadlines, care burdens, transportation requirements, institutional schedules, health, or coordination dependencies differ.

Temporal resource analysis is therefore relational. A one-hour interval can have different economic significance depending on whether counterparties, public offices, markets, transport systems, childcare arrangements, or technical systems are simultaneously available. The relevant resource can lie in synchronization rather than duration. Likewise, the capacity to wait can confer bargaining or strategic advantages when another party faces urgent liquidity, deadlines, expiring rights, or perishable goods.

Time can also be committed irreversibly or with substantial recovery costs. Train-

ing, caregiving, search, administrative compliance, commuting, maintenance, and coordination consume time that cannot always be recovered through additional financial expenditure. Temporal scarcity can therefore interact with income, household structure, infrastructure, institutional access, and labor relations in ways that make nominally identical choices practically different.

For GRE, temporal resources are especially important because economic histories are event ordered. Earlier commitments can close later options, delays can change the field to which a decision applies, and the value of a resource can depend on whether it becomes available before or after other events. Temporal analysis should therefore preserve sequencing and timing where they materially affect economic possibility rather than reducing time to an undifferentiated scalar input.

12.16.4 Spatial Resources

Spatial resources concern economically consequential location, proximity, reach, territorial position, mobility, and access to places in which resources, institutions, people, markets, infrastructures, or opportunities are situated. Space is not economically significant only as distance. Accessibility depends on the relation between locations and opportunities, including the transport, cost, time, institutional, and infrastructural conditions through which those opportunities can be reached (Hansen 1959).

A location can therefore function as a resource because it enables proximity to employment, customers, suppliers, schools, care networks, transport hubs, public services, ecosystems, cultural institutions, or regulatory jurisdictions. It can simultaneously impose costs through congestion, pollution, exposure, rent, jurisdictional restrictions, or vulnerability to disruption. Spatial resourcehood should be specified relative to the activity and subject under consideration.

Digital connectivity can transform spatial resources without eliminating spatial dependence. Remote communication can reduce some coordination costs while leaving logistics, energy, physical care, legal jurisdiction, time zones, embodied work, land use, and infrastructure geographically situated. Platform-mediated access can also make apparently remote resources contingent on data centers, networks, payment systems, language communities, or regulatory territories that remain spatially organized.

Spatial resources are often cumulative and path dependent. Infrastructure, land-use patterns, housing, institutional concentration, agglomeration, and historical investment can make some locations increasingly connected while others remain costly to reach. GRE treats these patterns as relational configurations whose boundaries and relevant scale depend on the question, rather than assuming a single spatial unit such as the city, region, or nation.

12.16.5 Informational Resources

Informational resources include data, records, measurements, signals, classifications, forecasts, descriptions, and other representations that can reduce uncertainty, coordinate action, support evaluation, or make economic conditions observable. Information possesses economic properties that differ from many ordinary material goods.

Arrow's analysis of invention and information emphasizes uncertainty and appropriation problems that complicate ordinary commodity treatment (Arrow 1962). In GRE, the additional concern is relational: information becomes a usable resource only when it can be accessed, interpreted, trusted sufficiently for the purpose, and connected to an action or learning process.

The quantity of information therefore does not measure informational resourcefulness. Large datasets can have low practical value when provenance is unknown, variables are poorly aligned with the inquiry, access is delayed, or interpretation is absent. A small amount of timely and well-contextualized information can be highly consequential. Informational resources should consequently be described through quality, relevance, granularity, timeliness, provenance, interoperability, interpretability, and rights of access where these dimensions matter.

Information can also be performative. A rating, forecast, eligibility category, risk score, market price, or public announcement may alter expectations and actions, thereby changing the field that the representation described. Information can therefore be both a resource for observation and an epistemic event that changes subsequent economic relations. The practical value of the information may depend partly on how other actors receive and act upon it.

Information is also unevenly distributed. Hayek's analysis of dispersed knowledge shows why coordination problems arise when relevant knowledge is distributed among actors rather than concentrated in one decision center (Hayek 1945). GRE extends the concern to the relations that determine which actors can observe, share, withhold, interpret, certify, or contest information. These positions can become resources or sources of dependency even without direct ownership of material assets.

12.16.6 Knowledge Resources

Knowledge resources include skills, know-how, conceptual understanding, procedural competence, tacit expertise, technical knowledge, organizational routines, and learned capacities that can support economic action. Human-capital analysis provides one established economic representation of acquired education and training as productive investment (Becker 1964). GRE retains the importance of learning and acquired competence while using a broader relational account that distinguishes possession of codified information from the ability to interpret, apply, adapt, teach, or combine it in a particular configuration.

Knowledge can be embodied in persons, distributed across teams, stabilized in routines, encoded in documents or software, incorporated in technical artefacts, or preserved through institutions and professional communities. These forms have different transfer conditions. A manual may be copied rapidly while the practical competence required to use it develops slowly; tacit knowledge may require apprenticeship or recurrent interaction; organizational knowledge may depend on coordination among people who individually possess only fragments of the relevant process.

Knowledge resources are consequently vulnerable to loss through turnover, organizational restructuring, technological change, language discontinuity, destruction of archives, or weakening of communities of practice. Conversely, knowledge can accumulate through learning-by-doing, experimentation, research, teaching, collab-

oration, and recombination. The relevant economic resource may lie in the capacity to generate new knowledge rather than only in a stored body of existing knowledge.

Knowledge also interacts with authority and institutional recognition. A person can possess practical expertise without having the credential or organizational standing required to exercise it; a credential can grant access while only imperfectly representing competence. Knowledge-resource analysis should therefore distinguish epistemic capacity, recognized qualification, decision authority, and practical opportunity to apply knowledge.

12.16.7 Attentional Resources

Attention becomes an economic resource because observation, interpretation, learning, coordination, and decision require selective cognitive and organizational focus. Simon's analysis of information-rich environments emphasizes that an abundance of information consumes the scarce attention of recipients and therefore creates a problem of allocating attention among competing sources (Simon 1971). The GRE treatment includes individual attention but also extends to organizational and institutional arrangements that determine what becomes visible, prioritized, monitored, escalated, or ignored.

Attentional resources are not adequately described by total available time. Two organizations with similar staffing can differ in attentional capacity because reporting systems, incentives, expertise, interruptions, hierarchy, information architecture, or crisis load channel focus differently. A decision process can fail because relevant information never reaches the position capable of acting on it, because warning signals compete with routine reporting, or because the cost of sustained monitoring exceeds available organizational attention.

Attention is also relationally contested. Firms compete for consumer attention; political and administrative systems allocate attention among problems; managers allocate attention among units and indicators; digital interfaces rank and filter what users encounter. These arrangements can create gatekeeping positions over visibility even where the underlying information remains technically available.

The economic value of attention therefore depends on selection and context. More attention is not uniformly beneficial, and concentrating attention on one issue necessarily changes the attention available elsewhere. GRE treats attention as a scarce and allocable resource whose organization can generate both capacities and blind spots. The relevant inquiry should identify the mechanism through which attention affects action rather than treating attention as a universal scalar commodity.

12.16.8 Infrastructural Resources

Infrastructural resources are shared material, technical, organizational, informational, or institutional conditions that can support multiple downstream activities. Frischmann's demand-side account of infrastructure emphasizes the economic significance of resources that serve as inputs into heterogeneous productive and social uses (Frischmann 2012). GRE uses this insight in conjunction with the platform and infrastructure analysis developed earlier in the chapter: an infrastructural resource

is important not merely because it exists, but because access to it enables a range of further relations and capacities.

Examples can include transport systems, energy networks, communication backbones, payment rails, legal registries, identity systems, shared scientific facilities, standards, databases, public spaces, and organizational support systems. Their resource character can be distributed. A participant may use an infrastructure without owning it, while ownership of an infrastructural asset may confer limited practical control when regulation, interoperability obligations, technical dependence, or joint governance constrain unilateral action.

Infrastructural resources often display complementarities and shared dependence. Their failure can therefore propagate across activities that appear otherwise unrelated. Conversely, infrastructural improvement can create new option sets by reducing coordination, transport, verification, search, or compatibility costs across many downstream processes. These effects should be identified empirically rather than inferred from the label “infrastructure.”

Access conditions are especially important. A nominally public or technically open infrastructure can remain unevenly usable because of fees, location, disability, language, technical standards, credentials, devices, complementary services, or knowledge. The distinction between infrastructural availability and effective infrastructural access prepares a separate analysis of access as an economic relation and condition in its own right.

12.16.9 Institutional-Access Resources

Institutional-access resources consist of recognized statuses, entitlements, licences, credentials, procedural standing, legal capacities, administrative classifications, and other institutionally mediated positions that enable or condition participation in economic processes. These resources are relational because their practical effect depends on recognition by institutions and counterparties. A licence matters because specified authorities and participants treat it as authorizing conduct; a credential matters because organizations use it in admission, employment, or professional classification; an entitlement matters because institutions recognize a claim to provision, transfer, or access.

Sen’s entitlement analysis provides a clear illustration of how legally and socially structured command over goods can diverge from aggregate availability (Sen 1981). North’s institutional analysis likewise emphasizes how rules structure interaction and incentives (North 1990). GRE focuses on the access relation generated by such structures. The institutional resource lies neither solely in the text of a rule nor solely in an individual’s attributes; it lies in the recognized position and the mechanisms through which that position can be exercised.

Institutional-access resources can be cumulative. Prior education can create eligibility for a credential; the credential can create eligibility for an occupation; employment can generate insurance, pension, credit, or residency consequences; recognized organizational status can create access to procurement, finance, or regulatory channels. These sequences make institutional resources historically path dependent even when each individual step is formally rule governed.

Institutional access can also be fragile. Documentation can expire, classifications can change, discretionary interpretation can vary, organizations can lose accreditation, or procedural barriers can make recognized rights costly to exercise. Analysis should therefore distinguish formal entitlement, administrative recognition, procedural usability, and realized access. The next sections on capacities, constraints, and access will build on this distinction.

12.16.10 Relational Resources

Relational resources arise from positions and histories within social, organizational, institutional, and economic relations. They can include trust, reputation, reciprocal obligations, information channels, cooperative experience, sponsorship, brokerage positions, shared norms, and access mediated through networks. Coleman analyzes social capital as resources embedded in social structure, including obligations and expectations, information channels, norms, and closure (Coleman 1988). Granovetter's embeddedness argument likewise demonstrates that economic action can depend materially on ongoing social relations rather than on atomized exchange alone (Granovetter 1985).

GRE treats relational resources as configuration-specific rather than as a universally positive stock of "social capital." A dense network can facilitate trust and coordination while also restricting entry, reinforcing conformity, or concentrating information within a closed group. A brokerage position can create valuable access across otherwise separated groups while making others dependent on the broker. Reputation can reduce transaction uncertainty in one field while being irrelevant or even constraining in another.

Relational resources also require maintenance. Trust can erode; obligations can be discharged or contested; network positions can change as actors enter, exit, or form new ties; organizational restructuring can dissolve channels through which information previously moved. A relational resource can therefore disappear without any obvious physical asset being destroyed. Conversely, repeated cooperation can generate relational capacities that were absent at the beginning of the interaction.

The distribution of relational resources is often uneven and historically cumulative. Family position, education, occupation, organizational membership, migration history, language, geography, discrimination, and prior institutional participation can shape which relationships are practically available. GRE does not infer normative legitimacy from these resources. It treats them as economically consequential relations whose mechanisms, accessibility, and distribution can be investigated.

12.16.11 Resource Convertibility

Resource convertibility concerns the conditions under which one resource form can be transformed, mobilized, or exchanged into another economically relevant resource or capacity. Convertibility is central to economic architecture because many practical strategies depend on such transformations: financial resources purchase material inputs; time and attention contribute to learning; knowledge can support income generation; institutional recognition can open access to finance or occupa-

tions; relational resources can provide information or opportunities; infrastructure can make spatially distant resources practically reachable. These conversions are common, but they are neither automatic nor universally reversible.

The capability literature provides one useful precedent for treating conversion as heterogeneous: persons can obtain different functionings from similar commodity or resource bundles because personal, social, and environmental conversion conditions differ (Sen 1985; Robeyns 2005). GRE generalizes the analytical concern beyond person-level welfare. Conversion can depend on institutions, networks, technologies, timing, location, complementary resources, power, standards, and prior histories at individual, organizational, community, or system scales.

Proposition 12.78 (Situating resource convertibility). *The convertibility of a resource is conditional on a specified conversion mechanism and relational configuration. Conversion rates, losses, delays, reversibility, and accessible outputs can vary across subjects, positions, institutions, scales, and historical periods.*

Proposition 12.78 cautions against treating resource forms as universally commensurable. Financial wealth can often expand choice, yet it cannot instantly produce trusted relations, accumulated expertise, biological recovery, institutional legitimacy, or elapsed time. Knowledge can sometimes be monetized, but market demand, legal rights, organizational position, reputation, language, and complementary assets condition the conversion. A credential can improve occupational access while remaining weakly transferable across jurisdictions. A transport infrastructure can convert spatial separation into practical accessibility for some users while leaving others excluded by cost, disability, documentation, or service design.

Conversion can also be lossy and path dependent. Selling an illiquid asset under urgency may realize only part of its longer-horizon value; converting land to another use can destroy ecological or cultural capacities that are difficult to recover; reorganizing a community relation into a priced transaction can change expectations and obligations; using reputation to obtain short-term advantage can alter the trust that made the reputation valuable. Resource conversion can therefore modify the source relation as well as the destination resource.

Convertibility is frequently asymmetric. One resource may be readily converted into another while the reverse path is costly or unavailable. Money can purchase professional advice without creating the professional's accumulated experience in the purchaser; institutional authority can compel reporting without generating trust; attention can be directed toward learning, yet prior lost time cannot be reconstructed through later attention alone. These asymmetries make resource architecture more informative than a single aggregate measure of wealth or capital for many GRE questions.

Remark 12.79 (Resource plurality and analytical aggregation). GRE permits aggregation when a well-defined empirical or formal purpose justifies it. Aggregation should preserve the distinctions needed for the inquiry and should not imply that heterogeneous resources possess a universal conversion metric. Where conversion is conditional, asymmetric, delayed, or lossy, those conditions remain part of the economic explanation.

Resources are therefore neither isolated stocks nor merely labels applied to use-

ful things. They are objects and conditions whose economic relevance is generated through relations of access, recognition, timing, compatibility, knowledge, infrastructure, and conversion. Material, financial, temporal, spatial, informational, knowledge, attentional, infrastructural, institutional-access, and relational resources can interact and partially transform into one another, yet the transformations depend on historically specific mechanisms. This resource architecture prepares the analysis of capacities and constraints by separating what is potentially mobilizable from what a subject or configuration can actually do under prevailing relational conditions.

12.17 Capacities and Constraints

Resources describe conditions that may be available for economic use, while capacities concern what subjects and configurations can actually do under prevailing relational conditions. Constraints concern the conditions that delimit, redirect, delay, condition, or make costly those possible actions and transformations. This section develops capacities and constraints as historically situated features of economic architecture rather than as fixed attributes attached independently to persons, organizations, or institutions. Its objective is to distinguish important loci of capacity and constraint while preserving their interaction across scales. The discussion proceeds through individual, collective, organizational, institutional, epistemic, and relational capacities, followed by material, institutional, and relational constraints and the transformation of constraints over time. The method is conceptual and comparative, drawing on capability, institutional, collective-action, organizational, and relational traditions where they clarify the economic mechanisms at issue. Table 12.19 summarizes the principal distinctions.

The distinction between resources and capacities is especially important. Research on capabilities has long emphasized that possession of commodities or resources does not determine what persons are substantively able to do or be, because conversion conditions differ across persons and environments (Sen 1985; Robeyns 2005). GRE adopts the broader analytical lesson while extending it beyond person-level welfare. A resource can contribute to capacity only through relations of access, compatibility, timing, knowledge, coordination, recognition, authority, and complementary support. Similar resource bundles can therefore support markedly different capacities across persons, organizations, communities, or institutions.

Definition 12.80 (Economic capacity). For a specified economic inquiry, an *economic capacity* is a historically situated ability of a subject or relational configuration to initiate, sustain, resist, coordinate, transform, or complete an economically consequential process under specified conditions. Capacity attribution should identify the relevant subject or configuration, the class of actions or transformations at issue, and the conditions under which the capacity can be exercised.

Definition 12.81 (Economic constraint). For a specified economic inquiry, an *economic constraint* is a material, institutional, relational, epistemic, temporal, technical, ecological, organizational, or other condition that changes the feasible, accessible, timely, or sustainable set of actions or transformations available to a subject or configuration. Constraint attribution is relative to the process, scale, time horizon,

and counterfactual alternatives relevant to the inquiry.

Definitions 12.80 and 12.81 keep capacity and constraint analytically relational. A condition can support one capacity while constraining another. A licensing regime can restrict entry while creating recognized professional standing; a technical standard can narrow design choices while enabling interoperability; a budget can limit expenditure while supporting planning discipline; a contractual commitment can reduce short-run discretion while enabling longer-run coordination. GRE therefore treats constraints as structuring conditions whose practical significance must be specified rather than as synonymous with harm or deficiency.

Proposition 12.82 (Resource–capacity non-equivalence). *Resource availability does not by itself establish economic capacity. Capacity depends on the relations through which resources can be accessed, combined, converted, coordinated, interpreted, and exercised under relevant constraints.*

Proposition 12.82 provides the immediate bridge from Section 12.16. Financial resources can remain unusable where settlement infrastructure is unavailable; information can remain practically inert where interpretive capacity is absent; legal entitlement can fail to generate effective access where procedures are inaccessible; collective resources can fail to support coordinated action where trust, authority, or shared expectations have broken down. Conversely, strong capacities can sometimes be generated from modest resource stocks through organization, cooperation, knowledge, institutional access, or favorable timing.

12.17.1 Individual Capacity

Individual economic capacity concerns what a person can effectively do within a specified economic process under prevailing relational and historical conditions. Relevant capacities can include producing, learning, moving, negotiating, refusing, caring, saving, investing, organizing, communicating, changing occupation, making claims, or participating in institutions. The appropriate description depends on the inquiry. A labor-market analysis may focus on capacities for occupational entry, mobility, and bargaining; a household analysis may focus on provisioning and care; a financial analysis may focus on capacities to transact, absorb shocks, or obtain credit.

Capacity should not be inferred directly from nominal resources or formal rights. The capability approach provides a useful precedent for distinguishing means from substantive opportunities and for recognizing heterogeneous conversion factors (Sen 1985; Robeyns 2005). A person with nominal access to education may lack time, transport, language support, documentation, caregiving substitutes, or financial capacity to participate. A worker with a contractual right to resign can face practical limits created by debt, immigration status, health insurance dependence, geography, specialized credentials, or limited alternative employment. GRE therefore treats individual capacity as jointly constituted by personal conditions and surrounding relations without reducing it to either side.

Individual capacity is also temporally structured. Skills can accumulate or decay; health and energy can vary; caregiving obligations can change; institutional eligibility can expire; savings can provide temporary waiting capacity; repeated exclusion can narrow future options. An assessment at one moment can therefore miss the

Table 12.19: Selected capacities and constraints in economic architecture.

Dimension	Illustrative analytical object	Questions requiring specification
Individual capacity	Action, refusal, learning, mobility, bargaining, care, production, adaptation	Resources, conversion conditions, health and embodiment where relevant, legal status, time, information, alternatives, and support
Collective capacity	Joint provision, coordination, mutual support, common governance, pooled action	Membership, complementarity, trust, coordination, contribution, distribution, authority, and free-riding or conflict conditions
Organizational capacity	Recurrent production, service delivery, coordination, adaptation, implementation	Roles, routines, authority, resources, knowledge, interfaces, redundancy, learning, and external dependence
Institutional capacity	Rule formation, recognition, adjudication, administration, enforcement, public provision	Legitimacy, jurisdiction, procedures, information, staffing, finance, compliance, coordination, and historical credibility
Epistemic capacity	Observation, interpretation, diagnosis, forecasting, learning, model revision	Data access, expertise, attention, representation, uncertainty, model plurality, feedback, and contestability
Relational capacity	Capacity produced through positions, ties, trust, obligations, brokerage, or coordinated histories	Network position, reciprocity, recognition, dependency, alternatives, maintenance, asymmetry, and institutional embedding
Material constraint	Physical, ecological, technical, spatial, energetic, or temporal limitation	Mechanism, substitutability, degradation, thresholds, complementarity, timing, and scale
Institutional constraint	Rule, classification, procedure, jurisdiction, standard, entitlement, or enforcement condition	Scope, authority, interpretation, compliance, contestability, path dependence, and differential incidence
Relational constraint	Dependency, exclusion, hierarchy, coordination burden, distrust, lock-in, conflict, or positional limitation	Relation form, affected position, alternatives, exit capacity, feedback, cumulative effects, and transformation pathways
Constraint transformation	Change in the conditions structuring feasible action	Intervention, innovation, learning, institutional change, collective action, resource conversion, redistribution, and unintended effects

historical processes that generated the present capacity and the processes through which it may expand or contract.

The same person can possess strong capacity in one dimension and weak capacity in another. High income can coexist with little discretionary time; technical expertise can coexist with limited institutional standing; formal authority can coexist with weak relational trust. GRE consequently avoids compressing individual capacity into

a single scalar unless a specific empirical purpose and defensible aggregation rule justify doing so.

12.17.2 Collective Capacity

Collective capacity arises when coordinated relations among multiple participants make possible actions or transformations that are weakly available or unavailable to participants acting separately. Examples include mutual insurance, collective bargaining, common-resource governance, cooperative production, community provision, pooled investment, shared maintenance, emergency response, or coordinated standard setting. Collective capacity therefore depends on configuration as well as membership.

Research on collective action and commons governance demonstrates that coordinated capacity can arise under institutional arrangements more varied than a simple state-versus-private dichotomy (Ostrom 1990). For GRE, the relevant point is methodological: collective capacity should be reconstructed through the mechanisms that support joint action. These can include shared rules, monitoring, communication, trust, sanctioning, recognized leadership, distributed expertise, repeated interaction, common infrastructure, and expectations about reciprocal contribution.

Collective capacity does not imply equal participation or equal benefit. A group may act effectively while concentrating agenda setting in a small subset of members. A coalition may mobilize substantial resources while placing disproportionate burdens on less powerful participants. A supply network may achieve high productive coordination while creating fragile dependence on a few nodes. Analysis should therefore separate the existence of collective capacity from its internal distribution, governance, accessibility, and normative evaluation.

Collective capacity can also depend on external relations. Community action can require public legal recognition, financing, technical expertise, transport, or organizational partners. A labor coalition can depend on statutory rights and enforcement. A research consortium can depend on shared infrastructure and funding agencies. Collective capacity is therefore rarely closed within the collectivity itself; it can be generated through higher-order relations spanning institutions and scales.

12.17.3 Organizational Capacity

Organizational capacity concerns the ability of an organization to reproduce or transform coordinated activity across persons, roles, resources, routines, and external relations. Relevant capacities can include production, service delivery, adaptation, learning, implementation, monitoring, financing, negotiation, maintenance, and crisis response. Section 12.11 treated organizations as relational condensations; the present subsection focuses specifically on what those condensations make practically possible.

Organizational capacity depends on more than aggregate resources. Equipment, funds, personnel, and information can coexist with weak implementation where roles are unclear, authority is fragmented, routines conflict, knowledge is inaccessible, or external dependencies are poorly coordinated. Conversely, routines,

redundancy, institutional memory, and distributed expertise can allow an organization to maintain performance under resource pressure. The relevant unit of analysis is therefore the configuration linking resources to coordinated action.

Complex organizations can exhibit capacity heterogeneity across internal units. A corporation can possess strong engineering capability and weak regulatory capability; a ministry can possess rule-making authority and limited administrative reach; a university can generate research while lacking capacity to transfer knowledge into a particular application. Near-decomposable and nested structures can help explain why capacity in one subsystem does not automatically transfer to another (Simon 1962).

Organizational capacity can be cumulative and path dependent. Repeated activity can generate tacit knowledge, routines, external credibility, supplier relations, technical infrastructure, and learned coordination. Reorganization can destroy some of these capacities even when formal assets remain. Capacity assessment should therefore include both visible resources and historically generated relational structures whose loss may only become apparent after disruption.

12.17.4 Institutional Capacity

Institutional capacity concerns the ability of institutional arrangements to perform economically consequential functions such as recognizing status, setting rules, administering procedures, coordinating expectations, adjudicating disputes, providing public goods, collecting information, enforcing obligations, or enabling collective action. Institutions can distribute these functions across many organizations, professions, technologies, and legal positions; institutional capacity should therefore not be reduced to the budget or staffing of one organization.

North's analysis of institutions as humanly devised constraints structuring interaction highlights the economic significance of rules and their evolution (North 1990). GRE extends the inquiry toward the capacity of institutional configurations to enact and reproduce those rules in practice. A formal entitlement possesses limited practical significance where administrative procedures cannot process claims, records are unreliable, responsible offices lack authority, or enforcement is absent. Conversely, stable expectations can sometimes be supported by informal practices even where formal codification is limited.

Institutional capacity is multidimensional. Legislative capacity, administrative capacity, adjudicative capacity, fiscal capacity, regulatory capacity, informational capacity, and coordinative capacity can develop unevenly. Strength in one dimension can also create constraints elsewhere: extensive monitoring capacity can improve compliance while increasing administrative burden; standardized classification can improve comparability while reducing sensitivity to heterogeneous cases; rapid discretionary action can improve responsiveness while weakening predictability or contestability.

Institutional capacity can therefore expand through both accumulation and redesign. Additional resources matter, but so can clarified jurisdiction, interoperable records, procedural simplification, professional competence, institutional trust, or improved relations among organizations. The same reform can increase one insti-

tutional capacity while reducing another, which makes explicit scope specification important.

12.17.5 Epistemic Capacity

Epistemic capacity concerns the ability of a subject or configuration to generate, access, interpret, compare, communicate, revise, and act upon knowledge relevant to an economic process. It can depend on data, measurement systems, expertise, theoretical models, historical records, attention, organizational memory, information channels, and the practical authority to use or challenge an interpretation. Epistemic capacity therefore links resources of information and knowledge to processes of judgment and learning.

Economic knowledge is often distributed across actors and locations. Hayek's classic discussion of dispersed knowledge emphasizes that relevant information can be local, incomplete, and unavailable to any single decision maker in centralized form (Hayek 1945). GRE retains this coordination problem while widening the analysis to the institutional and relational conditions through which dispersed knowledge becomes visible, translated, contested, or ignored.

Epistemic capacity is not equivalent to data volume. Large datasets can coexist with weak understanding where categories are poorly matched to the process, historical changes undermine comparability, models suppress relevant heterogeneity, or organizational incentives discourage revision. Conversely, situated expertise, small samples, qualitative evidence, or local observation can sometimes provide high diagnostic value. Appropriate epistemic capacity therefore depends on the problem and on the composition of methods. Domain-general methodological analysis elsewhere in GRE treats that composition as a situated and revisable problem rather than as a fixed hierarchy of methods.

Epistemic capacity is also performative in some settings. A forecast, classification, rating, or diagnostic model can alter expectations and behavior when actors respond to it. The capacity to know and the capacity to influence can therefore become entangled. Analysis should identify when representations remain primarily descriptive and when their institutional uptake changes the field that subsequent evidence will describe.

12.17.6 Relational Capacity

Relational capacity is capacity generated through positions and histories within relations rather than through isolated attributes alone. Trust can enable cooperation without continuous monitoring; reputation can facilitate access to counterparties; brokerage can connect otherwise separated groups; reciprocal obligations can provide support during shocks; recognized authority can coordinate action; repeated collaboration can generate shared routines and mutual interpretation. These capacities arise through relational configurations and can weaken when those configurations change.

The literature on embeddedness and social capital provides useful precedents for analyzing economic resources and possibilities located in social structure (Granovet-

ter 1985; Coleman 1988). GRE treats relational capacity more broadly and cautiously. Dense ties can support information and cooperation while limiting entry or exposing participants to conformity pressures. Brokerage can create connectivity while concentrating dependence on an intermediary. Trust can reduce coordination costs while increasing vulnerability where it suppresses verification. The same relational configuration can therefore generate multiple capacities and constraints simultaneously.

Relational capacity is often non-transferable. A person who moves across organizations or jurisdictions may lose the practical value of reputation, trust, informal knowledge, or reciprocal obligations that depended on a previous field. An organization entering a new market can possess financial and technical resources while lacking relationships needed for distribution, regulatory interpretation, recruitment, or local legitimacy. Capacity analysis should therefore identify the relations in which the capacity is instantiated and the conditions under which it travels.

Relational capacity can also be shared without being equally controlled. A professional community may collectively sustain standards from which members benefit while a smaller group controls certification. A platform ecosystem may generate broad matching capacity while platform governance determines access conditions. The existence, distribution, and control of relational capacity are separate analytical questions.

12.17.7 Material Constraints

Material constraints arise when physical, biological, ecological, technical, spatial, energetic, or temporal conditions shape the feasible set of economic actions. Examples can include limited land, equipment capacity, energy availability, travel time, climatic exposure, biological recovery, storage limits, transport bottlenecks, technical compatibility, or infrastructure degradation. The relevant constraint is the mechanism through which the material condition affects the process, rather than materiality in the abstract.

Material constraints can be hard at one horizon and transformable at another. A bridge capacity is fixed for a given day yet expandable through investment over several years. Biological recovery imposes timing conditions that financial expenditure may only partly alter. A technical incompatibility can constrain exchange until a standard or interface is redesigned. The distinction between current constraint and transformable constraint therefore depends on the time horizon and available transformation mechanisms.

Substitution also requires explicit analysis. A scarce input can be substitutable in one production process and indispensable in another. Alternative technologies can require different complementary infrastructure, skills, ecological inputs, or institutional approval. Treating material constraints as prices alone can therefore conceal technical and relational conditions that determine whether substitution is actually feasible.

Material constraints can generate distributional differences. The same heat event, transport disruption, energy shortage, or spatial barrier can affect subjects differently according to housing, income, infrastructure, health, occupational role, loca-

tion, or institutional access. A system-level material constraint should therefore not automatically be inferred to impose a uniform subject-level constraint.

12.17.8 Institutional Constraints

Institutional constraints arise through rules, norms, classifications, procedures, jurisdictions, standards, entitlements, enforcement practices, and expectations that shape accessible economic action. Such constraints are central to institutional economics, where institutions structure interaction and incentives (North 1990). In GRE, institutional constraint is interpreted relationally: the same rule can create different practical constraints across positions because subjects differ in status, resources, information, procedural capacity, and available alternatives.

Institutional constraints frequently have enabling dimensions. Property registration constrains transfer through formal procedure while enabling recognized claims; accounting standards constrain representation while supporting comparison; professional licensing narrows entry while creating recognized competence categories; procurement rules restrict discretion while supporting procedural predictability. Analysis should therefore state which capacity is constrained and which capacities, expectations, or protections the same institution may help generate.

Institutional constraint can also operate through classification. Eligibility categories, occupational statuses, organizational forms, credit ratings, or regulatory classifications can determine which rules apply and which opportunities become accessible. Because classifications can be performative, institutional constraints may change behavior before formal enforcement occurs, particularly when actors anticipate future treatment.

Institutional constraints are historically revisable. Rules can be amended, reinterpreted, circumvented, ignored, or transformed through practice. Their practical durability depends on legitimacy, enforcement, administrative capacity, coordination, and expectation. A constraint can remain formally unchanged while becoming weaker or stronger in effect as surrounding institutions and relations evolve.

12.17.9 Relational Constraints

Relational constraints arise when a subject's feasible actions are conditioned by positions within relations of dependency, authority, obligation, trust, conflict, exclusion, coordination, or network structure. A firm can be technically capable of switching suppliers yet remain constrained by certification, compatibility, long-term contracts, accumulated learning, or customer expectations. A worker can possess transferable skills yet face occupational constraints through credential recognition, geography, care obligations, or immigration status. A household can own an asset while being constrained in its use by debt, co-ownership, social obligations, or institutional rules.

Relational constraints are often asymmetric. Dependence can be mutual while the cost of disruption differs sharply across participants. Authority can coordinate joint action while limiting unilateral discretion for subordinate positions. Trust can enable exchange while making verification socially costly. Network closure can support reputation and sanctioning while limiting access for outsiders. These examples make

it useful to specify the affected position rather than describing the relation itself as uniformly constraining.

Relational constraints can also be emergent. No participant may individually impose a coordination bottleneck, yet the interaction among standards, routines, expectations, contracts, and installed infrastructure can make alternative action costly. Such constraints can persist even after the original reasons for a configuration have weakened because accumulated complementarities and expectations stabilize the existing path.

Remark 12.83 (Constraint and normative evaluation). Calling a condition a constraint identifies its role in structuring feasible action for a specified inquiry. It does not by itself establish that the constraint is undesirable. Some constraints protect rights, support coordination, reduce harmful action, preserve resources, or create predictable expectations. Other constraints can generate exclusion, domination, fragility, or avoidable loss. Normative evaluation requires additional criteria and situated analysis.

12.17.10 Constraint Transformation

Constraint transformation concerns changes in the conditions that structure feasible economic action. Constraints can be relaxed, intensified, displaced, redistributed, internalized, externalized, or converted into different forms through technical innovation, institutional change, collective action, learning, investment, migration, organizational redesign, resource conversion, political decision, or ecological change. The transformation of one constraint can simultaneously create another.

Technical change provides a simple illustration. A digital communication system can reduce spatial and coordination constraints while increasing dependence on electricity, connectivity, standards, cybersecurity, identity systems, or platform governance. Financial innovation can relax liquidity constraints while creating new informational or systemic dependencies. A new transport link can expand labor-market access while changing land values, commuting patterns, congestion, and local ecological pressure. Constraint transformation is therefore better treated as reconfiguration than as simple removal.

Institutional reform can have similar effects. Simplifying a licensing process can reduce entry burdens while increasing the importance of ex post monitoring. Expanding eligibility for a benefit can reduce income constraints while increasing administrative demand. Decentralization can reduce one form of centralized bottleneck while increasing coordination burdens across jurisdictions. These changes should be evaluated across the relevant positions, scales, and time horizons rather than through a single aggregate measure of constraint reduction.

Capacities and constraints can also co-evolve. A capacity developed to address one constraint can alter the future structure of constraints. An organization that develops sophisticated compliance capacity may gain access to highly regulated markets while becoming dependent on specialized administrative systems. A community that creates effective commons governance can generate collective capacity while also establishing membership obligations and boundary rules. A state that expands informational capacity can administer programs more effectively while creating new

questions about classification, surveillance, and contestability.

Proposition 12.84 (Capacity–constraint coevolution). *Economic capacities and constraints can co-evolve because exercising or expanding a capacity can modify the relations that define later feasible action, while constraints can induce learning, coordination, substitution, institutional development, or other capacity-forming responses. The direction and normative significance of this coevolution remain empirical and historically situated questions.*

Proposition 12.84 cautions against treating capacity expansion as a simple movement toward unconstrained action. Economic action always occurs within some structure of material, institutional, temporal, ecological, and relational conditions. The analytical task is therefore to identify which capacities are generated, who can exercise them, which constraints are transformed or displaced, and what new dependencies or possibilities emerge through the transformation.

Capacities and constraints jointly describe the practical architecture through which resources become economically consequential. Individual, collective, organizational, institutional, epistemic, and relational capacities are generated through different combinations of resources and relations, while material, institutional, and relational constraints shape the actions through which those capacities can be exercised. Their coevolution provides the immediate basis for a more focused analysis of access: the existence of a capacity or resource does not establish who can actually reach, claim, activate, or benefit from it under prevailing economic relations.

12.18 Economic Access

Economic architecture can contain resources, institutions, infrastructures, knowledge, networks, and decision processes whose practical significance depends on whether relevant subjects can actually reach, use, invoke, participate in, or influence them. This section develops *economic access* as the relational condition linking nominal availability to effective economic participation and capacity. Its objective is to distinguish several recurrent access mechanisms without reducing access to a single scalar measure or treating greater access as an unconditional normative good. The discussion proceeds through access to resources, institutions, knowledge, infrastructure, networks, and decision-making, followed by differentiated and mediated access and the transformation of access conditions. The method is conceptual and comparative. Capability, institutional, network, infrastructure, and information traditions are used where they clarify the mechanisms through which nominally available objects become practically usable. Table 12.20 summarizes the principal dimensions.

Access is analytically distinct from existence, ownership, entitlement, capacity, and realized use. A resource can exist without being reachable; a legal entitlement can exist without being procedurally usable; information can be publicly available without being interpretable; an infrastructure can be physically present without being affordable or technically compatible; a network can be extensive while remaining inaccessible to a particular actor; and a decision process can formally invite participation while offering little practical influence. Conversely, access can sometimes

exist through informal, mediated, temporary, shared, or contingent arrangements even where formal ownership or membership is absent. These distinctions make access a relational property of an economic configuration whose meaning depends on the conditions of reachability and practical use.

Definition 12.85 (Economic access). For a specified economic inquiry, *economic access* is the historically situated practical relation through which a subject or configuration can reach, invoke, use, participate in, draw upon, or exercise influence over an economically consequential resource, institution, body of knowledge, infrastructure, network, or decision process under specified conditions. An access claim should identify the object of access, the relevant subject or configuration, the mechanism of access, the conditions of continued usability, and the time horizon of the claim.

Definition 12.85 treats access as more than a binary state. Access can vary in depth, reliability, timing, cost, quality, discretion, continuity, and dependence on intermediaries. A person can possess emergency access to a resource without stable long-term access; an organization can use an infrastructure while lacking control over its interface; a community can have nominal participation rights while lacking timely information needed to exercise them; and an actor can enter a network while remaining peripheral to the relations through which opportunities are generated.

Proposition 12.86 (Availability–access non-equivalence). *The availability or formal existence of an economically relevant object does not by itself establish effective access to it. Effective access depends on the relational conditions through which the object can be reached, recognized, interpreted, afforded, combined, invoked, or used within the relevant time horizon.*

Proposition 12.86 extends the means-versus-capability distinction associated with capability-oriented analysis. Sen's treatment of substantive freedom and Robeyns's account of conversion factors both emphasize that nominal means do not uniquely determine effective opportunities (Sen 1999; Robeyns 2005). GRE applies this lesson more broadly to economic architecture. The relation between an available object and an effective capacity is mediated by access conditions, while access itself can depend on other resources, capacities, institutions, and relations.

Table 12.20 should be read as an open and revisable analytical repertoire. Several dimensions can apply simultaneously, and the relevant form of access depends on the problem. Access to credit, for example, can involve financial resources, institutional eligibility, information, network reputation, digital infrastructure, and a decision process through which an application is classified. A study that reduces the problem to one dimension can therefore miss the mechanism that actually determines practical access.

Remark 12.87 (Access and normative evaluation). GRE does not treat greater access as an unconditional good. Some forms of access may be harmful, coercive, unsafe, environmentally damaging, or inconsistent with other situated commitments. The analytical task is first to identify how access is produced and distributed; normative evaluation requires additional specification of the relevant subjects, consequences, values, rights, responsibilities, and alternatives.

Table 12.20: Selected dimensions of economic access.

Dimension	Illustrative access mechanism	Questions requiring specification
Resource access	Possession, entitlement, purchase, sharing, borrowing, allocation, claim, or conversion	Availability, recognition, affordability, timing, divisibility, complementary inputs, conversion conditions, and continuity
Institutional access	Eligibility, recognized status, documentation, standing, procedural entry, administrative recognition	Jurisdiction, classification, information, language, cost, waiting time, procedural burden, enforcement, and contestability
Knowledge access	Observation, education, documentation, transmission, interpretation, expertise, consultation	Availability, intelligibility, attention, language, tacit knowledge, uncertainty, credibility, and capacity to act on knowledge
Infrastructure access	Physical connection, technical interface, service eligibility, shared use, interoperability	Coverage, reliability, price, compatibility, standards, congestion, maintenance, quality, alternatives, and temporal availability
Network access	Membership, referral, tie formation, brokerage, repeated participation, reputation	Entry conditions, position, tie quality, reciprocity, trust, gatekeeping, closure, alternatives, and maintenance
Decision access	Voice, representation, agenda access, information rights, deliberation, authorization, review, appeal	Standing, timing, information, authority, procedural position, effective influence, accountability, and implementation
Differentiated access	Uneven access across positions, groups, places, times, and relational histories	Distribution, conversion conditions, cumulative advantage, burden, exposure, alternatives, and persistence
Mediated access	Broker, platform, credential, classification, professional intermediary, institution, technical interface	Mediator authority, dependence, fees, opacity, ranking, discretion, accountability, substitutability, and exit
Access transformation	Institutional change, infrastructure, learning, standardization, redistribution, technical redesign, network restructuring	Who gains or loses access, new dependencies, temporal effects, feedback, path dependence, and reversibility

12.18.1 Access to Resources

Access to resources concerns the conditions under which material, financial, temporal, spatial, informational, attentional, infrastructural, institutional, or relational resources can be practically mobilized. Resource existence and resource access are therefore distinct analytical questions. A public facility can exist at a geographic location while remaining inaccessible because of distance, cost, opening hours, disability, documentation, language, or transport. Financial wealth can exist in an illiquid form while offering little immediate capacity to meet an urgent payment. Shared resources

can exist within a household or organization while control over their use remains uneven.

Resource access can be direct or conditional. Direct access can involve possession, recognized entitlement, or immediate use. Conditional access can depend on price, approval, collateral, membership, contribution, reciprocity, queuing, scheduling, or compliance with a technical or administrative requirement. These mechanisms differ economically because they distribute waiting time, uncertainty, bargaining position, future obligations, and the possibility of refusal in different ways.

The capability perspective is useful here because it distinguishes resources from the substantive opportunities that can be generated from them (Sen 1999; Robeyns 2005). GRE extends the analysis by making the access relation itself explicit. Two subjects can face the same nominal resource offer while differing in liquidity, information, time, documentation, complementary infrastructure, social support, or institutional standing. Their effective access can therefore differ before any further difference in resource conversion is considered.

Resource access is also temporally structured. Emergency access, temporary access, recurring access, secure long-term access, and contingent access provide different practical capacities. A short-term credit facility may bridge a liquidity gap while creating future repayment constraints. Temporary housing can provide immediate shelter while offering little long-term locational stability. Time-limited data access can support one analysis while preventing later verification. Access analysis should therefore specify duration, renewal conditions, and the consequences of interruption where these matter.

Finally, access can depend on combinations of resources. Money can purchase transport only where transport exists; institutional entitlement can be exercised only where information and administrative capacity are available; network membership can yield opportunities only where actors have time and knowledge to use them. Resource access is consequently often configurational and should be analyzed through the combination of enabling conditions that make use possible.

12.18.2 Access to Institutions

Access to institutions concerns the practical ability to invoke, enter, use, contest, or be recognized within rule-governed arrangements. Institutions structure economic action through classifications, rights, duties, procedures, standards, enforcement, and expectations. North's institutional analysis emphasizes the role of formal and informal constraints in structuring interaction (North 1990). For access analysis, the important question is how those structures become usable or binding for differently situated subjects.

Institutional access can depend on eligibility, jurisdiction, recognized identity, documentation, credentials, procedural standing, language, fees, waiting periods, deadlines, information about available procedures, and the practical capacity to comply with administrative requirements. Formal entitlement can therefore coexist with weak practical access. A benefit may exist in law while application procedures, proof requirements, administrative delay, or lack of information make uptake difficult. A court or dispute-resolution procedure may be formally open while cost, time, repre-

sentation, or evidentiary burdens affect effective use. A professional license can create access to an occupation while making entry conditional on training, examination, fees, recognition of prior credentials, and continuing compliance.

Institutional access can also be mediated by classification. Recognition as an employee, resident, student, creditor, owner, dependent, licensed professional, eligible beneficiary, or qualified supplier can open or close a set of economic relations. Because classification can alter recognized rights, obligations, and opportunities, access analysis should examine both the rule and the process through which a subject is placed within the relevant category.

Access to institutions is not exhausted by successful entry. Effective use can depend on procedural continuity, timely response, understandable communication, appeal, correction of records, and the capacity to contest an adverse determination. Where an institution allocates scarce resources or permissions, access can also depend on queues, priority rules, discretion, or competition among applicants. These features make institutional access an ongoing process whose conditions can continue to change after entry.

12.18.3 Access to Knowledge

Access to knowledge concerns the relations through which economically consequential information, expertise, interpretation, and know-how become available and practically usable. The distinction between information and knowledge matters. Information can be recorded and transmitted while interpretation depends on concepts, expertise, context, language, experience, and the ability to distinguish relevant signals from noise. Hayek's analysis of dispersed knowledge remains useful for showing that economically relevant knowledge can be distributed across actors and contexts (Hayek 1945).

Knowledge access therefore involves more than publication or disclosure. It can depend on education, documentation, language, professional communities, tacit apprenticeship, data infrastructure, search capability, trusted intermediaries, and time for interpretation. Technical documentation can be openly published yet unusable without specialized background. A worker can know that a legal right exists while lacking the procedural knowledge required to exercise it. A firm can possess large data sets while lacking the expertise or attention required to identify a relevant pattern.

Attention is a particularly important access condition. Simon's observation that information abundance creates a scarcity of attention helps explain why nominal information availability can coexist with weak practical access (Simon 1971). Search, ranking, filtering, curation, and organizational routines therefore affect which knowledge becomes cognitively and institutionally accessible. These mechanisms can enable action while also privileging some representations over others.

Knowledge access can also be relationally unequal because some knowledge remains tacit, confidential, proprietary, localized, or embedded in practice. Network position can affect early access to information; organizational hierarchy can affect which reports are visible; professional status can affect whose interpretation is treated as credible. Epistemic quality should be evaluated independently of access

position. The distribution of knowledge access remains economically consequential where it changes opportunity, bargaining, coordination, or the interpretation of uncertainty.

12.18.4 Access to Infrastructure

Access to infrastructure concerns the practical ability to use shared material, technical, organizational, or institutional systems that support heterogeneous downstream activity. Frischmann's demand-side account of infrastructure is relevant because it emphasizes infrastructures as shared inputs into multiple productive and social uses (Frischmann 2012). GRE focuses here on the access relations through which those shared conditions become available to particular subjects and processes.

Physical proximity does not determine infrastructural access by itself. Hansen's classic formulation of accessibility as a relation between locations and opportunities illustrates why reachability depends on more than geometric distance (Hansen 1959). Transport, energy, communications, payments, logistics, data, health, education, and other infrastructures can require connection, affordability, compatible equipment, recognized service status, technical literacy, reliability, and sufficient quality. A broadband network can pass a building without providing affordable usable connectivity; a transport network can exist while schedules or fares make an opportunity practically unreachable; a payment rail can be technically available while identity or account requirements prevent participation.

Infrastructure access is often layered. One layer concerns physical or technical connection. Another concerns service eligibility. A third concerns reliability and quality. A fourth concerns the downstream applications that can be reached through the infrastructure. These layers can fail independently. Formal connection can therefore coexist with unstable service, congestion, low quality, or lack of interoperable downstream services.

Access conditions can also create dependency. If a subject reorganizes production, communication, mobility, or finance around one infrastructural system, interruption can become increasingly costly. This does not make dependence inherently undesirable; shared infrastructure often creates substantial collective capacity. It does mean that access analysis should include continuity, substitutability, governance, and recovery where interruption would materially alter the feasible action set.

12.18.5 Access to Networks

Access to networks concerns entry into and position within recurrent relations through which information, opportunities, trust, referrals, resources, coordination, or recognition can travel. Granovetter's embeddedness argument shows how economic action can depend on ongoing social relations (Granovetter 1985); Powell's analysis of network forms likewise demonstrates that recurrent relational structures can coordinate economic activity through mechanisms distinct from pure market or hierarchical forms (Powell 1990). Access to such structures can therefore have economic consequences even where no formal membership right exists.

Network access has at least two dimensions. The first concerns entry: whether a

subject can form a tie, join a group, participate in a professional community, reach a broker, or become recognized by relevant actors. The second concerns position: what can actually be reached once entry occurs. Two actors can belong to the same network while differing substantially in centrality, brokerage, tie strength, reputation, reciprocity, and access to consequential parts of the network.

The economic value of network access is also conditional. A dense network can support trust and coordination while limiting exposure to alternative information. Brokerage can create access across otherwise separated groups while increasing dependence on intermediaries. Strong ties can provide reliable support while weak ties can sometimes connect actors to different information or opportunities. GRE therefore avoids treating network connectivity as a monotonic measure of advantage.

Network access can be cumulative. Existing ties can generate reputation or referrals that make further ties easier to form. Conversely, exclusion from early opportunities can reduce the probability of later recognition. Such processes can create path-dependent access patterns even without a single actor intentionally designing them. Empirical analysis should therefore distinguish current network position from the historical processes through which that position emerged.

12.18.6 Access to Decision-Making

Access to decision-making concerns the practical relations through which subjects can receive relevant information, present claims, contribute knowledge, influence agendas, participate in deliberation, authorize action, challenge a determination, or affect implementation. This dimension matters economically because decisions about allocation, standards, investment, employment, membership, infrastructure, classification, and organizational strategy can reshape later access and capacity.

Decision access should be disaggregated. Presence in a meeting is different from agenda-setting power; consultation is different from authorization; voting is different from control over implementation; the right to submit information is different from having that information considered; formal representation is different from the practical ability to communicate with representatives. The relevant access mechanism depends on the decision process being studied.

Access also has a temporal dimension. Information provided after a practical deadline offers different decision access from information available before agenda formation. An appeal that occurs only after irreversible implementation can have a different practical function from review that can suspend an action. Timing can therefore determine whether participation changes the feasible decision set or merely records disagreement after the fact.

GRE treats the appropriate depth and form of participation as situation-dependent. Specialized expertise, delegated authority, confidentiality, emergency conditions, scale, and transaction costs can make different decision arrangements appropriate under different circumstances. The analytical requirement is narrower: where decision access is economically consequential, the study should identify who can enter which stage of the process, through what mechanism, with what information and authority, and with what possibility of review or contestation.

12.18.7 Differentiated Access

Economic access is frequently differentiated across subjects, positions, places, times, organizations, and relational histories. Differentiation can arise through resource distribution, eligibility rules, infrastructure, price, language, knowledge, network position, organizational role, geography, technical compatibility, caregiving obligations, or accumulated reputation. Equal formal rules can therefore produce different effective access where conversion conditions differ.

Differentiated access can be horizontal or vertical. Horizontal differentiation occurs where actors have access to different resources, institutions, or networks without a clear ordering among them. Vertical differentiation occurs where some positions provide systematically broader, more reliable, cheaper, or more influential access than others along a relevant dimension. The distinction matters because heterogeneous specialization does not automatically imply hierarchy, while unequal control over consequential access points can generate durable asymmetry.

Access differentiation can also accumulate over time. Early institutional recognition can create access to education, employment, credit, or networks; those later positions can generate further resources and recognition. Conversely, an access interruption can produce losses that persist after the original barrier is removed. The analysis should therefore distinguish contemporaneous access gaps from historically compounded access trajectories.

Normative conclusions require additional specification. Differentiated access may sometimes reflect functionally relevant specialization, safety requirements, scarcity, professional competence, or other situated considerations. In other cases it may reflect exclusion, capture, inherited privilege, administrative friction, or avoidable design choices. GRE's analytical task is to reconstruct the mechanisms, incidence, consequences, alternatives, and historical formation before assigning normative status.

12.18.8 Mediated Access

Many access relations operate through mediation. Brokers, platforms, professional intermediaries, public agencies, credentials, classification systems, technical standards, search systems, rankings, and organizational gatekeepers can connect subjects to resources or opportunities that would otherwise be difficult to reach. Mediation can reduce search costs, verify information, translate rules, coordinate interfaces, pool demand, standardize transactions, or provide trust where direct interaction would be costly.

Mediation also changes the structure of access. The intermediary can acquire discretion over admission, visibility, ordering, certification, pricing, timing, or the conditions under which parties encounter one another. A platform can enable broad market participation while controlling ranking and interface rules. A credential can make expertise legible while excluding forms of competence that the credential does not recognize. A broker can connect separated networks while becoming a critical passage between them. These effects do not determine a single normative judgment, but they make the mediator part of the access architecture.

Proposition 12.88 (Mediated-access dependence). *Where practical access to an eco-*

nomically consequential object recurrently depends on a mediator; changes in the mediator's rules, classifications, interfaces, prices, or availability can alter the downstream capacities of subjects even when the underlying object remains otherwise unchanged.

Proposition 12.88 is intentionally conditional. The significance of mediation depends on alternatives, substitutability, switching costs, transparency, accountability, interoperability, and the depth of dependence. Where several comparable mediators exist, the practical effect of one intermediary's decision can be limited. Where access is concentrated through a difficult-to-replace interface, small rule changes can have large downstream consequences.

Mediated access can also obscure responsibility. A denial may appear to arise from an impersonal classification while the relevant rule was designed, selected, interpreted, or maintained by identifiable organizations. Conversely, an intermediary can be constrained by upstream legal, technical, contractual, or infrastructural conditions. Responsible analysis therefore traces the chain of mediation and distributes causal attribution across the relevant upstream and downstream conditions.

12.18.9 Transformation of Access Conditions

Access conditions can change through institutional reform, redistribution, infrastructure investment, organizational redesign, education, technical innovation, standardization, interoperability, network formation, new mediation, collective action, or changes in classification and recognition. Access transformation is therefore one mechanism through which economic architecture changes without requiring immediate transformation of the underlying resource itself.

An access intervention can operate at several points. It can expand the supply or geographic reach of an object; change eligibility or procedural requirements; reduce price or waiting time; provide complementary knowledge or infrastructure; redesign an interface; create portability or interoperability; establish a new intermediary; strengthen alternatives; or change the authority through which access decisions are made. These interventions can produce different relational consequences even where they generate similar short-run participation rates.

Access expansion can also create new dependencies. Digitalization can reduce geographic barriers while increasing dependence on identity systems, software, connectivity, or platform governance. Standardization can improve interoperability while narrowing acceptable formats. Centralized provision can improve reliability while concentrating control. Informal mediation can increase reach while making access dependent on brokers. The relevant evaluation therefore concerns the transformed configuration, including the capacities and constraints that accompany the new access relation.

Transformation can be path dependent. Once organizations and households reorganize around an access channel, later changes to that channel can have consequences that were absent when it was introduced. Earlier exclusion can also leave residual effects through lost learning, reputation, savings, health, trust, or network position. Restoring formal eligibility may therefore fail to recreate the capacity that would have existed under uninterrupted access.

Proposition 12.89 (Access transformation and relational reconfiguration). *A change in economic access can reconfigure later capacities, dependencies, expectations, and relations even when the nominal resource, institution, or infrastructure remains unchanged. The significance of an access reform therefore depends on both immediate reachability and the subsequent relational processes it enables or constrains.*

Proposition 12.89 places access within the broader generative architecture of GRE. Access is neither a terminal outcome nor a sufficient measure of welfare, justice, or effectiveness. It is one condition through which resources, institutions, knowledge, infrastructure, networks, and decision processes become practically consequential. Analysis of later economic structures therefore benefits from preserving the distinction between what exists, who can access it, what capacities that access supports, and which new relations are generated through its use.

Remark 12.90 (Revisable access attribution). An access claim is an analytical commitment tied to a specified object, subject, mechanism, scale, and time horizon. Evidence that a formally available object is practically unusable, or that an apparently excluded subject possesses an alternative access route, should lead to revision of the access representation.

12.19 Ownership and Control

Ownership is one of the principal architectures through which economic systems organize claims over resources, assets, infrastructures, organizations, and the future uses that may be made of them. Control concerns the effective capacity to shape those uses, access conditions, rules, transfers, or later possibilities. This section develops ownership and control as related but non-equivalent dimensions of economic architecture. Its objective is to distinguish legal ownership, socially organized ownership, possession, use, exclusion, transfer, shared ownership, effective control, and rule-setting while avoiding the assumption that these dimensions necessarily coincide in one actor or institution. The discussion proceeds from legal and social ownership relations through possession, use, exclusion, transfer, and shared ownership, and then examines control without ownership, control over rules and access, and transformation of ownership relations. The method is conceptual and comparative. Institutional, property-rights, organizational, commons, and cooperative traditions are used to identify recurring mechanisms without treating any one legal or economic theory of property as a complete account of ownership in GRE. Table 12.21 summarizes the principal dimensions.

Ownership is often represented as a relation between a person and an object. For economic analysis, a broader relational representation is frequently needed. Ownership claims are constituted through relations among claimants, other subjects, institutions, rules, registries, organizations, enforcement arrangements, and the asset or resource to which the claims refer. The content of ownership can therefore vary across legal systems, organizational forms, asset types, historical periods, and practical settings. A title can be economically consequential because institutions recognize it, because other actors orient their conduct around it, because it supports exclusion or transfer, or because it allocates decision authority. The same formal title can nev-

ertheless generate different practical capacities where enforcement, information, liquidity, contractual conditions, collective governance, technical interfaces, or social recognition differ.

The property-rights literature provides several useful precedents for decomposing ownership. Schlager and Ostrom distinguish positions associated with different bundles of rights rather than treating property as a simple owned/unowned binary (Schlager and Ostrom 1992). In the incomplete-contract tradition, Grossman and Hart model ownership through the allocation of residual control rights when contracts cannot specify every future use of an asset, and Hart and Moore develop this logic further in relation to firm boundaries and control (Grossman and O. D. Hart 1986; O. Hart and J. Moore 1990). These approaches address different analytical problems, but they support a common caution relevant to GRE: an ownership label can conceal several separable relations whose configuration matters for economic capacity and future action.

Definition 12.91 (Ownership architecture). For a specified economic inquiry, an *ownership architecture* is the historically situated configuration of recognized claims, permissions, powers, restrictions, responsibilities, and enforcement relations through which subjects or collectives can possess, use, benefit from, exclude others from, transfer, govern, encumber, or otherwise shape the disposition of an economically consequential entity, resource, or relational position. The relevant dimensions and their holders should be specified rather than inferred from an undifferentiated ownership label.

Definition 12.91 is intentionally broader than a single legal doctrine and narrower than a general theory of property. It provides an analytical vocabulary for identifying which ownership-related relations are economically operative in a given problem. It does not imply that every listed dimension is present, that every dimension is transferable, or that the configuration is normatively justified.

Proposition 12.92 (Ownership–control non-equivalence). *Legal or socially recognized ownership does not by itself establish effective control over every economically relevant use, rule, access condition, or future disposition of an object. Effective control can also arise through contractual position, finance, technical architecture, regulatory authority, organizational role, information advantage, intermediation, dependency, or other relations without corresponding ownership title.*

Proposition 12.92 makes ownership and control separate empirical questions. It also applies in the opposite direction: an owner can hold recognized title while possessing limited practical control because of regulation, debt covenants, fiduciary obligations, collective governance, technical dependence, contractual commitments, shared rights, or weak enforcement. The analytical task is therefore to reconstruct the operative configuration rather than infer power from title alone.

Table 12.21 should be read as an open analytical repertoire. The dimensions can overlap, and the same institutional arrangement can distribute them across several subjects. A cooperative can combine collective ownership with differentiated managerial authority; a trust can separate control from beneficial claims; a lease can allocate use without ownership; a secured lender can influence significant decisions without holding ordinary title; and a digital platform can exercise access and rule-setting

Table 12.21: Selected dimensions of ownership and control.

Dimension	Illustrative economic content	Questions requiring specification
Legal ownership	Recognized title, property status, legal claims, duties, remedies, registrable interests	Jurisdiction, asset definition, title form, enforceability, competing claims, liability, and remedies
Social organization of ownership	Recognized expectations, customary claims, organizational practice, collective understandings	Recognition, legitimacy, enforcement, conflict, institutional support, and relation to formal law
Possession and custody	Physical or operational holding, safekeeping, immediate factual control	Holder, duration, authority, risk, responsibility, revocability, and relation to title
Use rights	Permission or capacity to employ an asset or resource for specified purposes	Scope, duration, conditions, intensity, complementary resources, restrictions, and external effects
Exclusion rights	Capacity to restrict or condition the access or use of others	Object or class of exclusion, authority, procedure, exceptions, enforcement, alternatives, and contestability
Transfer and alienation	Sale, assignment, gift, inheritance, licensing, delegation, encumbrance, or other disposition	Transferable dimension, consent, price, restrictions, reversibility, third-party effects, and residual obligations
Shared or collective ownership	Joint title, cooperative ownership, communal rights, co-ownership, trust-like or layered claims	Membership, voting, benefit rights, contribution, management, exit, conflict resolution, and internal inequality
Effective control	Practical capacity to determine significant uses, decisions, priorities, interfaces, or residual choices	Source of control, scope, duration, dependence, accountability, alternatives, and relation to formal title
Rule-setting and access control	Capacity to define eligibility, interfaces, permissions, standards, procedures, or terms of participation	Rule-making authority, affected subjects, information, review, enforcement, delegation, and exit
Ownership transformation	Reallocation or reconfiguration of claims, powers, restrictions, and control relations	Mechanism, historical sequence, distributional effects, path dependence, residual claims, and institutional adaptation

control over assets or activities formally owned by others. The relevant architecture is therefore relational and configuration-specific.

Remark 12.93 (Ownership and normative evaluation). GRE does not treat private, public, cooperative, common, shared, or other ownership forms as carrying a fixed normative ranking. Ownership arrangements can generate capacities, security, coordination, stewardship, investment, participation, dependency, exclusion, concentration, conflict, or other consequences under different conditions. Normative evaluation requires specification of the relevant subjects, histories, values, responsibilities, alternatives, and generated relations.

12.19.1 Legal Ownership Relations

Legal ownership relations concern institutionally recognized claims and powers associated with an asset, resource, organization, or other legally cognizable object. Their content depends on the relevant legal order. Title can support use, exclusion, transfer, security interests, inheritance, remedies, or standing in disputes, while also carrying taxes, liabilities, duties, fiduciary restrictions, public-law constraints, or other obligations. Legal ownership is therefore economically significant through the relational consequences attached to the recognized status, rather than through the title word alone.

A legal ownership relation can be represented analytically by identifying at least four elements: the recognized holder or holders; the legally specified object or interest; the incidents or powers attached to the status; and the institutions through which the claim is interpreted, registered, enforced, limited, or contested. This representation is useful because the same physical object can support several legally distinct claims. Land can be subject to leases, easements, mortgages, zoning restrictions, environmental obligations, communal rights, or public access rules. Financial and organizational assets can likewise contain layered claims whose priorities and control consequences differ.

The incomplete-contract literature provides one influential economic representation of legal ownership through residual control rights. Grossman and Hart emphasize that where contracts cannot specify every future contingency, ownership can allocate authority over unspecified uses of assets (Grossman and O. D. Hart 1986). Hart and Moore use a related property-rights framework to analyze firm boundaries and more general control structures (O. Hart and J. Moore 1990). GRE treats this as one useful formalization under specified assumptions rather than as a universal definition of ownership. Legal systems can organize property through rights, duties, public constraints, collective claims, beneficial interests, and procedural rules whose economic relevance can extend beyond residual asset control.

Legal ownership also interacts with the access architecture developed in Section 12.18. A title can create access to credit, legal remedies, rental income, decision procedures, or transfer markets, but these capacities can depend on registration, documentation, liquidity, institutional recognition, complementary knowledge, and the willingness of others to transact. Legal ownership is consequently one source of economic capacity whose practical realization remains relational.

12.19.2 Social Organization of Ownership

Ownership is also organized through social recognition, expectations, customary practices, organizational routines, and repeated relations. These social dimensions can support formal law, supplement it, conflict with it, or remain partially independent from it. An economic analysis limited to registered title can therefore miss operative claims that shape who may use a resource, who is expected to maintain it, who receives benefits, who may transfer it, and whose objections are treated as consequential.

Institutional economics provides a useful precedent for treating working rules and

collective action as constitutive of economic relations. Commons emphasizes institutions as collective action that structures individual action through working rules (Commons 1931). In a related but distinct domain, Ostrom's research on commons demonstrates that durable resource arrangements can depend on locally developed rules, monitoring, membership, and governance that cannot be reduced to a simple private-versus-state ownership dichotomy (Ostrom 1990; Ostrom 2005). These traditions motivate attention to ownership as socially enacted while leaving the precise legal and normative status of particular claims to the relevant context.

Socially organized ownership can matter where formal rules are ambiguous, incomplete, expensive to invoke, weakly enforced, or mediated through organizations and communities. Repeated recognition can stabilize expectations about control and benefit. Social practice can also disadvantage actors whose claims receive weak recognition despite formal entitlement. The analytical problem is therefore not to replace legal ownership with social convention, but to examine how formal and informal recognitions jointly shape practical ownership capacities.

The social organization of ownership is historically revisable. Migration, technological change, organizational restructuring, legal reform, financialization, environmental change, inheritance, and shifts in community membership can alter which claims are recognized and how conflicts are resolved. GRE therefore treats socially organized ownership as an empirical configuration whose persistence requires explanation.

12.19.3 Possession and Custody

Possession concerns factual holding or immediate control over an object, while custody emphasizes responsibility for keeping, operating, or safeguarding it under some recognized arrangement. These relations can coincide with ownership but frequently do not. A tenant possesses a dwelling without owning it; a warehouse holds goods owned by clients; an employee operates equipment owned by an organization; a custodian can be responsible for an asset while lacking discretion over its transfer or final use.

Possession can generate substantial economic capacity because proximity and immediate control affect timing, monitoring, maintenance, access, and bargaining position. Physical possession of a scarce input can permit production to continue while a distant owner has formal title. Possession can also generate responsibilities and risks, including maintenance, loss, damage, compliance, or return obligations. The economic significance of possession therefore depends on the surrounding legal, contractual, technical, and relational conditions.

A possession claim should specify duration and revocability. Temporary possession under a lease, bailment, employment relation, loan, or emergency arrangement differs from possession backed by an indefinite claim. The possibility of revocation can affect investment, maintenance, planning, and dependency even when current use is uninterrupted. Historical experience of dispossession or unreliable tenure can likewise shape behavior beyond the formal terms of the present arrangement.

Possession is especially useful analytically when ownership data provide a poor approximation of practical control. At the same time, possession should not be treated

as sufficient evidence of legitimate ownership, durable access, beneficial entitlement, or rule-setting authority. It is one dimension within the broader ownership architecture.

12.19.4 Use Rights

Use rights concern recognized permissions or practical capacities to employ an asset or resource for specified activities. Their scope can be narrow or broad, continuous or temporary, exclusive or shared. Use can be attached to ownership, membership, contract, public entitlement, customary practice, license, organizational role, or informal permission.

Property-rights analysis of common-pool resources provides a useful vocabulary for separating access and withdrawal or use rights from higher-order management, exclusion, and alienation rights (Schlager and Ostrom 1992). The distinction matters beyond natural resources. Software licenses, leased equipment, shared laboratories, public infrastructure, intellectual-property arrangements, housing, cooperative assets, and organizational facilities can all grant use while reserving ownership or higher-order rule-setting elsewhere.

The economic value of a use right depends on conditions beyond formal permission. Timing, reliability, quality, complementary infrastructure, technical standards, congestion, maintenance, insurance, information, and restrictions on adaptation can determine whether the right supports a meaningful capacity. A right to use equipment only during unsuitable hours or through an incompatible interface can provide substantially less capacity than its formal description suggests.

Use rights can also generate obligations. Users may be required to contribute to maintenance, observe safety rules, preserve a shared resource, report usage, refrain from harmful activities, or return an asset in specified condition. GRE therefore treats use as a relation embedded within a configuration of capacities, constraints, responsibilities, and future effects.

12.19.5 Exclusion Rights

Exclusion rights concern the capacity to determine who may enter, access, use, or benefit from an economically consequential object or relation and under what conditions. Exclusion can support investment, privacy, security, stewardship, congestion management, or coordination. It can also restrict alternatives, produce dependency, or concentrate bargaining power. Its economic role is therefore mechanism- and context-dependent.

Schlager and Ostrom distinguish exclusion from other property rights in their analysis of natural-resource regimes (Schlager and Ostrom 1992). This separation is particularly useful for GRE because control over exclusion can be held by actors who do not possess every other ownership incident. A regulator can determine eligibility for use; a platform can control access to an interface; an association can set membership conditions; a landlord can retain some exclusion powers while granting possession; and a cooperative can distribute exclusion authority through collective procedures.

Exclusion should be specified in terms of object, subject, procedure, and alterna-

tives. A right to exclude one class of users can coexist with obligations to admit another. Exclusion can be conditional on payment, certification, safety, capacity, residency, membership, conduct, technical compatibility, or other criteria. Procedural rights of notice, review, appeal, or contestation can also affect the practical character of exclusion.

Effective exclusion can differ from formal exclusion. A formally exclusive owner can lack the practical means to enforce boundaries, while a non-owner can exercise strong *de facto* exclusion through technical standards, passwords, ranking systems, control of distribution channels, or organizational authority. This again illustrates why ownership and effective control require separate observation.

12.19.6 Transfer and Alienation

Transfer concerns the reallocation of ownership-related claims, permissions, obligations, or control positions between subjects. Alienation refers more specifically to the capacity to dispose of an ownership interest through sale, gift, assignment, inheritance, or other recognized mechanisms. Transferability varies widely across ownership dimensions: possession can be delegated without title; use can be licensed; income rights can be assigned; voting rights can be restricted; and some claims can be non-transferable by design or law.

The ability to transfer can generate liquidity, specialization, reallocation, inheritance, risk sharing, and adaptation. Restrictions on transfer can support continuity, stewardship, collective governance, public purpose, protection of vulnerable parties, or other situated commitments. GRE therefore treats transferability as an architectural variable rather than a presumption that more alienability is necessarily preferable.

Transfer also has a temporal and relational structure. A sale can extinguish some claims while preserving warranties, debt, easements, regulatory duties, environmental liabilities, employment obligations, service commitments, or other residual relations. The economic event is therefore rarely a complete erasure of prior history. Transfer can create a new ownership configuration while leaving parts of the former relational architecture in force.

Nozick's entitlement theory provides a historically influential normative account in which acquisition, transfer, and rectification play central roles (Nozick 1974). GRE does not adopt that theory as its normative foundation. Its relevance here is narrower: ownership analysis often requires historical attention to how a present claim was acquired, transferred, inherited, constrained, or contested. Present title alone may be insufficient when the inquiry concerns legitimacy, responsibility, path dependence, or residual obligation.

12.19.7 Shared and Collective Ownership

Shared and collective ownership distribute ownership-related claims across multiple participants rather than locating them in a single holder. This broad category includes co-ownership, cooperatives, communal arrangements, partnerships, trusts and trust-like structures, employee or consumer ownership, and other architectures in which

claims to use, benefit, govern, transfer, or control are distributed.

Collective ownership does not imply equal control. Voting rules, contribution requirements, delegated management, differential shares, expertise, information, agenda authority, and exit conditions can generate substantial internal differentiation. The International Cooperative Alliance, for example, defines cooperatives through joint ownership and democratic control while also specifying principles concerning membership, economic participation, autonomy, cooperation, and community concern (International Cooperative Alliance 1995; International Cooperative Alliance 2017). These principles illustrate one historically developed ownership architecture rather than a universal template for collective ownership.

Trust law provides another example of layered ownership-related relations. Hansmann and Mattei analyze trusts as arrangements that separate control, beneficial interests, and claims against assets in ways that cannot be represented adequately by a simple single-owner model (Hansmann and Mattei 1998). The economic significance of such arrangements lies partly in how different claims are partitioned and protected across parties.

Commons research likewise demonstrates that shared-resource governance can contain differentiated bundles of operational and collective-choice rights (Ostrom 1990; Schlager and Ostrom 1992). Collective ownership should therefore be reconstructed through its actual membership, use, benefit, management, exclusion, transfer, contribution, monitoring, and conflict-resolution relations.

Remark 12.94 (Shared ownership and internal heterogeneity). A shared ownership label should not be used as evidence of equal participation, equal benefit, equal exposure, or equal control. Analysis should identify how the relevant ownership dimensions are distributed internally and how that distribution changes through time.

12.19.8 Effective Control without Ownership

Effective control can arise without formal ownership where a subject or organization possesses practical capacity to determine economically significant uses, decisions, interfaces, or residual choices. Contractual authority, debt relationships, technical architecture, managerial position, information asymmetry, platform intermediation, regulation, procurement dependence, and control of complementary infrastructure can all generate such capacity under some conditions.

The incomplete-contract literature emphasizes residual control as one mechanism connecting ownership to decision authority (Grossman and O. D. Hart 1986; O. Hart and J. Moore 1990). GRE broadens the empirical question by allowing residual or effective control to be distributed across several relations. A nominal owner can depend on a lender for financing, a platform for market access, a supplier for indispensable inputs, a regulator for authorization, a manager for operational knowledge, and a standards body for compatibility. Significant practical control can therefore be dispersed or layered even where title is concentrated.

Control without ownership is especially important in digital and organizational settings. A platform can determine interface conditions, rankings, permitted conduct, or access to users while participants retain ownership of their own assets. An employer

can control work processes using leased equipment. A franchisor can shape substantial aspects of independently owned outlets through contractual and technical standards. A financial creditor can constrain investment or asset disposition through covenants. These examples differ institutionally, so the relevant control mechanism should be identified rather than inferred from a generic label.

Proposition 12.95 (Relational sources of effective control). *Effective economic control can be generated by ownership, contractual authority, organizational position, finance, information, technical architecture, institutional rule-setting, intermediation, or dependency, separately or in combination. Control attribution should therefore identify the mechanism through which consequential choices can actually be shaped.*

Proposition 12.95 also implies that control is dimension-specific. A lender can control financing conditions without controlling daily operations; a regulator can constrain permissible activity without determining ordinary production choices; a platform can control access while lacking ownership of participating firms; and a manager can possess operational discretion without the authority to sell major assets. Statements that an actor “controls” an economic object should therefore specify the relevant decision domain.

12.19.9 Rule-Setting and Access Control

Control over rules and access concerns the capacity to define the conditions under which other actors may participate, transact, use resources, enter infrastructures, exercise rights, or challenge decisions. This form of control can be economically consequential even when the rule-setter neither owns the underlying resources nor directly performs the regulated activity.

Rule-setting can occur through legislation, regulation, organizational governance, contracts, standards, technical protocols, platform terms, professional certification, membership procedures, or collective-choice arrangements. Commons’s concept of working rules highlights the importance of rules that structure what participants may, must, or must not do in economic transactions and collective action (Commons 1931). Ostrom’s institutional analysis similarly distinguishes operational action from collective-choice processes through which rules are formed or changed (Ostrom 2005; Schlager and Ostrom 1992).

Access control is closely related to, but analytically distinct from, ownership. A standards body can control compatibility; a regulator can determine licensing; a professional association can influence certification; a platform can govern admission and visibility; a cooperative can collectively determine membership; and a public authority can establish access conditions for publicly owned or privately operated infrastructure. The economic consequences depend on scope, alternatives, enforcement, transparency, review, and the distribution of rule-changing authority.

Rule-setting can also shape future ownership relations. Restrictions on transfer, eligibility, collateral, inheritance, interoperability, or organizational form can affect which actors can acquire or retain claims. Conversely, ownership concentration can shift rule-setting capacity toward owners through governance rights, political influence, technical control, or control of complementary assets. GRE therefore treats rule-setting and ownership as potentially recursive relations.

Remark 12.96 (Control over control). Where one actor can alter the rules governing another actor's access or decision authority, the analysis may need to distinguish first-order control over an economic activity from higher-order control over the conditions under which control itself is allocated, reviewed, or revised.

12.19.10 Transformation of Ownership Relations

Ownership relations transform through law, contract, exchange, inheritance, or organizational restructuring, financial arrangements, collective action, technological change, institutional reform, dispossession, restitution, standardization, and changes in social recognition. Transformation can alter one ownership dimension while leaving others comparatively stable. Legal title can remain constant while effective control migrates through debt, platform dependence, management, or technical standards; shared ownership can persist while voting rules change; public ownership can coexist with private operational control; and privatization or collectivization can reconfigure several dimensions at once.

Ownership transformation is therefore better represented as a change in configuration than as a simple switch between fixed categories. The relevant history can include changes in holders, objects, rights, obligations, boundaries, enforcement, access, rule-setting, and control. Some changes are readily reversible; others generate sunk investments, network dependence, institutional learning, legal commitments, or social expectations that make later restoration difficult.

Technological change can alter ownership architecture without directly changing title. Digital rights management can change practical use and transfer; cloud services can relocate operational control; interoperability can reduce dependence on a proprietary interface; automated governance systems can redistribute monitoring and enforcement; and new forms of tokenization or digital representation can create additional layers of claims. The economic significance lies in the changed capacities and relations rather than in technological novelty itself.

Transformation can also leave residual obligations. Former owners can retain warranty, pension, environmental, tax, confidentiality, or other duties. Communities can retain historical claims that remain socially or politically consequential after legal transfer. Organizations can inherit liabilities associated with acquired entities. A complete analysis therefore tracks what changes and what remains relationally active after the ownership event.

Proposition 12.97 (Ownership transformation as relational reconfiguration). *A transformation of ownership can alter economic architecture through changes in claims, use, exclusion, transferability, rule-setting, responsibility, access, or effective control even when the underlying physical asset remains unchanged. The significance of the transformation depends on which dimensions change, for whom, under what institutional conditions, and with what effects on later capacities and relations.*

Proposition 12.97 places ownership within the generative and historical architecture of GRE. Ownership affects more than current allocation. It can shape investment, maintenance, learning, bargaining position, participation, dependency, transfer possibilities, institutional authority, and the formation of future relations. These consequences remain empirical and context-sensitive. An ownership arrangement that

expands one capacity can constrain another, and similar legal forms can generate different trajectories under different institutional and relational conditions.

Remark 12.98 (Revisable ownership representation). An ownership representation is a purpose-relative analytical commitment. Evidence that legal title, possession, use, benefit, exclusion, transfer, rule-setting, or effective control are distributed differently from the initial representation should lead to revision of the ownership architecture used in the analysis.

12.20 Transfer and Circulation

Economic architecture is partly constituted by the movement and reallocation of claims, resources, permissions, obligations, information, possession, and control across subjects and configurations. This section develops *transfer* and *circulation* as relational processes whose economic significance depends on what changes position, through which mechanism, under which conditions, and with what residual relations. Its objective is to distinguish several recurrent transfer forms while avoiding the assumption that observable movement is equivalent to complete alienation, that circulation preserves an unchanged object, or that heterogeneous transferred forms can be reduced to a single conserved scalar. The discussion proceeds through exchange, gift, redistribution, contribution, sharing, lending, inheritance, extraction, cross-scale transfer, and the relational consequences of transfer. The method is conceptual and comparative, drawing on institutional, property-rights, entitlement, commons, and exchange traditions where they clarify the architecture of transfer. Table 12.22 summarizes the principal forms considered here.

Transfer and circulation are related but analytically distinct. A transfer concerns a change in the position of one or more economically consequential relations: ownership can move, possession can be delivered, use can be granted, money can be paid, an obligation can be assigned, information can be disclosed, or decision authority can be delegated. Circulation concerns linked sequences through which transferred objects, claims, obligations, or representations continue to move, return, accumulate, fragment, combine, or change form across a wider relational configuration. A single transfer can therefore occur without substantial circulation, while a circulation process can contain many transfers of different kinds.

Definition 12.99 (Economic transfer). For a specified economic inquiry, an *economic transfer* is a historically situated change in the allocation, possession, access, use, claim, obligation, information, benefit, or control position associated with an economically consequential object or relation. A transfer claim should identify the transferred dimension, the relevant parties or configurations, the mechanism of transfer, its temporal structure, the conditions attached to it, and any residual relations that remain after the event.

Definition 12.100 (Economic circulation). *Economic circulation* is a temporally extended configuration of linked transfers through which economically consequential objects, claims, obligations, resources, representations, or control positions move among subjects, organizations, institutions, scales, or relational domains. Circulation can include transformation, delay, return, accumulation, dissipation, capture,

or regeneration and therefore does not imply conservation of an unchanged object or scalar value.

Definitions 12.99 and 12.100 preserve distinctions established in the preceding analysis of ownership and control. Transfer of legal title need not coincide with transfer of possession, use, benefit, exclusion authority, or effective control. Conversely, control can shift through delegation, intermediation, contract, standards, or dependency without a change in formal ownership. The analytical object is therefore the changed relational position rather than a generic notion of “movement.”

Proposition 12.101 (Transfer–circulation non-equivalence). *A transfer event does not by itself establish a circulation process, and a circulation process need not consist of repetitions of one homogeneous transfer form. Circulation is established when linked transfers and their transformations form a temporally extended relational pattern whose organization contributes explanatory content to the economic inquiry.*

Proposition 12.101 matters because the same observed flow can arise through different architectures. A stream of payments can represent market exchange, debt service, redistribution, contribution, remittance, rent, licensing, inheritance, or a mixture of these. Similar aggregate flows can therefore embody different claims, obligations, bargaining positions, histories, and future dependencies. Conversely, one economically coherent circulation process can involve several media and transfer forms as resources and obligations change hands.

Table 12.22 is an open analytical repertoire rather than an exhaustive taxonomy. Several forms can coexist within one event. A household transfer can be simultaneously a contribution, a gift, and part of a longer reciprocal relation. A tax-financed public service can combine contribution, redistribution, institutional access, and cross-scale transfer. A loan can become a transfer of control if collateral, covenants, or refinancing dependence materially change decision authority. Classification should therefore follow the mechanism relevant to the inquiry rather than the surface form of the transaction.

Remark 12.102 (Transfer objects and heterogeneous value). The analysis of transfer architecture does not assume that an invariant scalar “value” travels unchanged between parties. What is transferred can change form, meaning, usability, timing, or relational significance as it moves. Money, time, knowledge, care, access, rights, obligations, reputation, and control can be only partially commensurable or conditionally convertible. Questions of heterogeneous value transmission therefore require analysis of the relevant conversion and relational conditions rather than inference from nominal transfer alone.

12.20.1 Exchange Relations

Exchange relations organize transfers through an understood relation between what one party gives and what another provides, promises, or makes available. The relation can be simultaneous or sequential, monetized or non-monetized, standardized or negotiated, formal or informal. Market exchange is one prominent form, yet exchange can also occur within organizations, households, communities, professional networks, and institutional arrangements.

Table 12.22: Selected forms and dimensions of economic transfer and circulation.

Transfer form	Relational organization	Questions requiring specification
Exchange	Reciprocal or contractually linked transfers under specified terms	Objects transferred, equivalence rule, timing, enforcement, information, residual obligations, and bargaining conditions
Gift	Transfer without a fully specified contemporaneous equivalent return	Recognition, expectation, reciprocity, obligation, status, timing, interpretation, and future relation
Redistribution	Collection, pooling, reassignment, or allocation through an organizational or institutional center or rule	Authority, contribution base, eligibility, allocation rule, administrative process, burden, incidence, and temporal horizon
Contribution	Transfer into a collective, organizational, communal, or infrastructural pool	Membership, obligation, voluntariness, benefit relation, governance, accounting, and use of the contributed resource
Sharing	Concurrent or sequential access, use, or benefit without complete alienation by one participant	Boundary, congestion, maintenance, scheduling, exclusion, contribution, responsibility, and continuity
Lending	Temporary transfer of possession, use, liquidity, or purchasing capacity with future return or settlement conditions	Duration, interest or fee, collateral, default, risk, enforcement, refinancing, and dependency
Inheritance	Transfer associated with death, succession, or intergenerational continuity	Legal rule, family or community structure, timing, obligations, taxation, indivisibility, control, and historical accumulation
Extraction	Transfer generated through an asymmetric capacity to appropriate, compel, price, tax, claim, capture, or externalize	Authority, bargaining position, alternatives, consent, incidence, externalized costs, contestability, and persistence
Cross-scale transfer	Movement among differently aggregated levels or configurations	Aggregation, incidence, leakage, mediation, transformation, feedback, scale mismatch, and attribution
Circulation consequence	Relational effects produced by repeated or linked transfers	Capacity, dependency, trust, authority, ownership, concentration, obligations, path dependence, and future action possibilities

An exchange analysis should specify the objects or performances being transferred, the terms linking them, the time structure, the recognized authority to transfer, and the conditions under which the agreement is enforced or revised. A purchase of equipment can transfer title, possession, warranty rights, payment obligations, and future service claims through one transaction. A labor contract can organize recurrent exchange while simultaneously generating authority, dependency, knowledge, and legal relations. The exchange relation is therefore often one

dimension of a thicker relational configuration.

Arrow's discussion of gifts and exchanges is useful because it emphasizes the continuing economic role of trust and other social relations even where exchange is formally organized through contracts or markets (Arrow 1972). GRE draws the narrower analytical lesson that explicit exchange terms do not remove the relational conditions of performance. Information, reputation, trust, enforcement, standards, infrastructure, and future interaction can affect whether a nominal exchange is practically realizable.

Exchange also need not imply equality of bargaining position or equivalence in a broader normative sense. Parties can agree to a transaction while facing different alternatives, information, urgency, institutional protections, or capacities to bear failure. The exchange relation should therefore be described separately from any conclusion about fairness, voluntariness, efficiency, or welfare.

12.20.2 Gift Relations

Gift relations involve transfers whose immediate terms do not specify a contemporaneous equivalent return. This does not imply absence of economic consequence or absence of future expectation. Gifts can create or express recognition, gratitude, obligation, affiliation, status, care, solidarity, patronage, reciprocity, or strategic relation. Their interpretation depends on the history and institutional setting in which the transfer occurs.

A gift can therefore be economically consequential even where accounting records classify it as zero-price transfer. The recipient can gain a resource or capacity; the giver can strengthen a relation, acquire reputation, express membership, or create an expectation of future conduct; third parties can reinterpret status or obligation. Arrow's comparison of gifts and exchanges provides a useful reminder that social relations and trust remain economically significant alongside formal exchange (Arrow 1972).

GRE does not assume that every gift conceals an exchange or that every gift creates a reciprocal obligation. The analytical question is empirical and interpretive: what expectations, meanings, permissions, or future relations become attached to the transfer in the configuration being studied? A gift among close relations, a charitable donation, a diplomatic gift, a platform subsidy, and a strategic corporate concession can have very different relational structures despite sharing the surface feature of transfer without immediate equivalent payment.

The timing of possible return matters. A gift can produce no later return, a diffuse expectation of reciprocity, a symbolic response, or a future material transfer whose timing and form are unspecified. This temporal openness distinguishes many gift relations from tightly specified exchange while preserving the possibility that gifts participate in longer circulation processes.

12.20.3 Redistributive Transfers

Redistributive transfers reorganize resources, claims, burdens, or access through a rule, organization, authority, or collective arrangement that gathers, reallocates, or

redirects economically consequential objects among differently situated participants. Taxation and public expenditure are familiar cases, but redistribution can also occur within households, organizations, insurance pools, cooperatives, charitable systems, mutual-aid arrangements, and other institutions.

The analysis should specify the contribution or collection mechanism, the allocation rule, the relevant administrative process, the eligible or affected positions, the timing of transfers, and the incidence of burdens and benefits. Aggregate fiscal flows can conceal substantial differences between statutory liability, economic incidence, administrative access, and realized benefit. Likewise, an organizational budget can redistribute resources among units while altering authority, staffing, information, and future bargaining positions.

Sen's entitlement analysis demonstrates why aggregate availability does not determine command over resources and why legally and institutionally structured transfers can affect effective access (Sen 1981). GRE uses this insight to treat redistribution as more than arithmetic reassignment. A redistributive transfer can change entitlements, expectations, dependency, institutional access, political or organizational relations, and later capacities.

Redistribution carries no fixed normative valence within GRE. A transfer can support insurance, social provision, risk sharing, organizational continuity, or capability formation; it can also create administrative dependency, exclusion through eligibility rules, or burdens whose distribution is contested. Evaluation requires the situated normative and empirical analysis appropriate to the relevant institution and history.

12.20.4 Contribution Relations

Contribution relations transfer resources, labor, knowledge, time, money, or other capacities into a shared, organizational, communal, infrastructural, or institutional configuration. Contributions can be voluntary, contractual, customary, mandatory, reciprocal, status-linked, or embedded in membership. Their economic significance depends on the relation between contribution, governance, use, benefit, and continuing obligation.

A contribution differs analytically from a simple bilateral exchange when the transferred object enters a pool or collective process whose later use is not exhausted by a direct return to the contributor. Membership dues, cooperative capital, tax payments, open-source work, maintenance labor, household provision, insurance premiums, and contributions to shared infrastructure illustrate different architectures. The contributor's later benefit can be direct, indirect, probabilistic, collective, delayed, symbolic, or absent.

Contribution analysis should identify who can require or request contributions, how amounts or forms are determined, whether contribution affects membership or voice, how the pooled resource is governed, and how benefits and burdens are distributed. In commons research, durable arrangements often depend on rules connecting appropriation, contribution, monitoring, and collective governance (Ostrom 1990; Ostrom 2005). GRE treats this as one important family of institutional arrangements without generalizing one commons design to all contribution systems.

Contributions can also generate path dependence. Repeated contribution can build shared infrastructure, organizational memory, trust, or collective capacity. It can equally generate expectations of continued support, unequal burdens, or dependency on a narrow contributor base. The relevant consequence depends on how contribution interacts with governance and access.

12.20.5 Sharing Arrangements

Sharing arrangements distribute access, use, benefit, or responsibility across several participants without requiring complete alienation of the underlying resource by one participant. Sharing can be simultaneous, scheduled, pooled, rotational, conditional, or governed by membership. It can apply to physical assets, infrastructure, knowledge, data, time, facilities, risks, or other economically consequential objects.

Sharing is analytically distinct from open access. A shared resource can have well-defined membership, use limits, scheduling rules, contribution obligations, maintenance duties, monitoring, and exclusion procedures. Ostrom's work on common-pool resources demonstrates the importance of institutional arrangements that organize collective use and governance rather than treating shared resources as unregulated open-access domains (Ostrom 1990). Property-rights analysis likewise distinguishes access and use rights from management, exclusion, and alienation (Schlager and Ostrom 1992).

The economic consequences of sharing depend on divisibility, congestion, compatibility, timing, maintenance, quality, and governance. Sharing an underused durable asset can increase utilization without materially reducing another user's capacity; sharing a congestible resource can generate interference; sharing information can permit simultaneous use while creating privacy, appropriation, or strategic concerns. The transfer architecture therefore varies with the properties of the object and the rules of use.

Sharing can also redistribute responsibility. Participants can acquire duties to maintain, report, replenish, repair, schedule, or preserve access for others. A complete analysis should therefore observe both the benefit relation and the governance burden through which sharing remains viable or becomes contested.

12.20.6 Lending and Temporary Transfer

Lending organizes temporary transfer of possession, use, liquidity, purchasing capacity, or other economic capability under conditions of return, repayment, settlement, or replacement. The transferred dimension should be specified because lending money differs from lending an object, granting temporary access, leasing productive equipment, or advancing inventory. Each architecture distributes control, risk, duration, and residual claims differently.

Credit is a particularly important lending relation because present capacity is linked to future obligation. A loan can expand the borrower's current action set while creating repayment schedules, interest obligations, collateral relations, covenants, information requirements, and possible consequences of default. The lender can gain a claim on future payment without acquiring ordinary ownership

of the borrower's assets, although collateral or contractual provisions can create conditional control rights.

Temporary transfer is therefore inherently temporal. Maturity, recall, renewal, grace periods, refinancing, depreciation, maintenance, and uncertainty about future conditions can affect the practical relation. Two loans of the same principal can create very different dependencies if one is readily refinanced and another matures during a period of weak alternatives. The history of repeated lending can also change reputation, access, bargaining position, and expectations.

Lending should not be reduced to the nominal transfer amount. The relevant configuration includes who bears price, default, liquidity, maintenance, technological, or other risks; who controls adaptation during the lending period; and which residual relations remain after repayment or return. A completed payment can extinguish one obligation while leaving information, reputation, collateral release, warranty, or institutional relations in place.

12.20.7 Inheritance and Intergenerational Transfer

Inheritance and intergenerational transfer relocate ownership claims, resources, obligations, knowledge, status, or control across generations or succession events. These transfers are economically significant because they connect present positions to accumulated histories that predate the current subjects and can influence later access, capacity, dependency, and institutional standing.

Inheritance is institutionally structured. Legal succession rules, wills, trusts, taxation, family forms, organizational constitutions, community practices, creditor claims, indivisibility of assets, and administrative procedures can shape what can be transferred and to whom. Transfer can concern more than wealth in a narrow financial sense. Businesses, land-use rights, professional knowledge, housing access, social networks, debts, care obligations, reputational positions, and organizational responsibilities can all have intergenerational dimensions.

A present ownership position therefore can contain inherited historical structure. Nozick's entitlement theory is one influential example of a normative framework that assigns central importance to acquisition, transfer, and rectification (Nozick 1974). GRE does not adopt this theory as a universal normative foundation. The narrower relevance is analytical: the history through which a holding or obligation was transmitted can matter when the inquiry concerns legitimacy, responsibility, path dependence, cumulative advantage, or unresolved claims.

Intergenerational transfer also demonstrates why circulation need not preserve the same object. A productive enterprise can be inherited as a legal entity while its technology, workforce, relationships, and market position change. Knowledge can be transmitted through education or apprenticeship while being reinterpreted. Land can remain physically located while the rights, uses, environmental conditions, and community relations attached to it change. The relevant continuity is therefore dimension-specific.

12.20.8 Extraction and Asymmetric Transfer

Extraction and asymmetric transfer concern transfer processes in which differences in authority, alternatives, bargaining position, information, ownership, institutional standing, technical control, or capacity materially shape who can appropriate resources or benefits and who bears corresponding costs or obligations. The term *extraction* is used here analytically rather than as an automatic normative verdict. Its application should identify the mechanism through which asymmetry affects the transfer.

Extraction can occur through several architectures. An owner can claim rent; a creditor can exercise priority; an intermediary can charge access fees; an organization can appropriate a share of collectively produced output; a state can levy taxes; a platform can set commissions; a dominant counterparty can shift risks through contract; or an actor can externalize costs onto parties outside the immediate transaction. These cases differ legally, institutionally, and normatively even when each contains a directional transfer.

The analytical task is therefore to specify authority, alternatives, incidence, consent conditions, rule-setting power, exit possibilities, and the distribution of costs and benefits. A transfer should not be classified as extractive merely because it is unequal in amount. Conversely, formal agreement does not by itself establish symmetric bargaining or absence of coercive dependence. The relevant question is how the relational configuration structures appropriation and burden.

Extraction can also alter the conditions of future transfer. Recurrent appropriation can reduce one party's resources or bargaining alternatives while increasing another's control, thereby making later transfers more asymmetric. Under other conditions, transferred surplus can support infrastructure, coordination, insurance, or capacities from which contributors benefit. A dynamic account should therefore trace what the transfer generates rather than infer its consequences from direction alone.

12.20.9 Cross-Scale Transfer

Cross-scale transfer concerns movement among differently aggregated levels or relational configurations, such as persons, households, organizations, communities, sectors, regions, states, transnational systems, or ecological-economic interfaces. The central analytical problem is that aggregation and disaggregation can change the apparent object, incidence, and meaning of the transfer.

A household can receive income while one member bears unpaid care burdens. A corporation can report a consolidated profit while resources move among subsidiaries. A region can receive investment while gains and costs are unevenly distributed locally. A state can receive tax revenue while collection and expenditure occur through different institutional channels and populations. Cross-scale analysis therefore requires attention to who or what is being aggregated at each stage.

Scale transitions can also transform the transferred object. Local knowledge summarized into organizational indicators loses some contextual information. Individual contributions pooled into an insurance fund become collective risk-bearing capacity. Small payments aggregated through a platform can finance infrastructure

or generate market power. National-level statistics can represent flows that do not correspond to transfers experienced by any single subject. The analytical relation between scales is therefore not a simple enlargement of the same object.

Proposition 12.103 (Cross-scale transfer attribution). *Claims about cross-scale transfer should distinguish the level at which a transfer is observed, the level at which costs and benefits are experienced, the mechanisms connecting those levels, and any transformations introduced by aggregation, mediation, or institutional processing.*

Proposition 12.103 is especially important where aggregate improvement is used to infer distributed benefit or where local loss is used to infer system-level decline. Neither inference is warranted without a mechanism linking the scales. Cross-scale circulation can include leakage, concentration, redistribution, transformation, or feedback that changes the relation between local and aggregate outcomes.

12.20.10 Relational Consequences of Transfer

Transfers do more than change the location of an object. They can modify ownership, access, capacity, obligation, authority, trust, reputation, dependency, expectations, and future bargaining positions. These relational consequences can persist after the transferred resource has been consumed, repaid, returned, or replaced. Transfer history can therefore become part of the economic architecture through which later action is organized.

A transfer can generate new relations. Lending creates repayment obligations; sharing can create maintenance duties; gifts can alter expectations; inheritance can reorganize membership and control; redistribution can create administrative access or classification; contributions can support collective capacity; extraction can reinforce dependency; exchange can establish reputational histories. The economic effect of transfer is consequently partly located in what the transfer makes possible or constrains afterward.

A transfer can also dissolve or weaken relations. Repayment can end a debt relation; sale can terminate some ownership claims; exit can end contribution obligations; redistribution can reduce a dependency on one source of provision; technical interoperability can weaken a gatekeeping relation. Yet dissolution is often partial. Records, warranties, liabilities, reputational effects, environmental consequences, learned expectations, and institutional classifications can remain after the primary transfer is complete.

Proposition 12.104 (Relational consequence of transfer). *Where a transfer changes later capacities, obligations, access conditions, authority, dependency, expectations, or feasible relations, the transfer should be analyzed as a transformation of economic architecture in addition to its immediate movement of resources or claims.*

Proposition 12.104 provides the main link between transfer analysis and the broader generative-relational programme. A transfer is economically consequential not only because something changes hands, but because the event can alter the relational conditions under which subsequent histories unfold. This does not imply that every transfer has large or durable effects. The relevant consequences remain empirical, scale-dependent, and historically situated.

12.21 Labor and Participation

Labor and participation connect economic subjects to processes through which goods, services, care, knowledge, infrastructures, organizational routines, and other capacities are produced, maintained, transformed, or reproduced. This section develops labor as an economic activity, relation, and contribution while keeping employment, remuneration, participation, and contribution analytically distinct. Its objective is to provide a sufficiently broad architecture for examining paid and unpaid labor, care and reproductive activity, knowledge-intensive work, automated and artificial participation, and forms of economic participation that extend beyond employment. The discussion is conceptual and comparative. It draws selectively on political economy, feminist economics, human-capital and knowledge traditions, labor-managed-firm analysis, and recent work on automation and algorithmic work where these literatures clarify particular dimensions. Table 12.23 summarizes the principal distinctions.

Labor is economically significant in more than one way. It can refer to activity performed, to a relation through which activity is organized, to a contribution to a collective process, or to a recognized category through which income, rights, obligations, status, and institutional protection are assigned. These dimensions often overlap, yet they need not coincide. Employment is one important institutional form of labor relation, but unpaid household work, care, voluntary contribution, cooperative participation, informal work, self-employment, and machine-mediated production demonstrate that economic participation exceeds standard employment categories. Classical political economy already treated labor and the division of labor as central to production and productive capacity (Smith 1776; Marx 1867). Feminist economics later made especially visible the economic importance of unpaid household and care activity that conventional accounting and labor categories can obscure (Waring 1988; Himmelweit 1995; Power 2004).

Definition 12.105 (Economic labor). For a specified economic inquiry, *economic labor* is purposive activity whose performance contributes to the production, maintenance, reproduction, transformation, coordination, or availability of economically consequential goods, services, capacities, relations, organizations, institutions, or infrastructures. A labor attribution should specify the activity, its organizational and relational conditions, the relevant time horizon, the form of recognition or compensation where present, and the mechanism through which the activity contributes to the economic process under study.

Definition 12.106 (Economic participation). *Economic participation* is a historically situated relation through which a subject, group, organization, or other relevant participant contributes to, is represented in, influences, depends on, or is affected by an economic process or configuration. Participation can occur through labor, ownership, governance, consumption, contribution, care, knowledge production, institutional membership, platform activity, community practice, or other mechanisms. Participation therefore does not imply employment, equal influence, equal benefit, or normative desirability.

Definitions 12.105 and 12.106 separate labor from the wider category of participation. A person can participate economically without performing labor in the nar-

row sense, for example through ownership, governance, consumption, investment, institutional membership, or receipt of care. Conversely, labor can be economically consequential even where it is weakly recognized, unpaid, informally organized, or excluded from conventional employment statistics. The analytical task is to identify the relation through which activity and participation matter rather than infer significance from one administrative category.

Proposition 12.107 (Labor–employment non-equivalence). *Employment status is neither a necessary nor a sufficient representation of economically consequential labor. Labor analysis should distinguish the activity performed, the relation organizing that activity, the form of compensation or recognition, and the capacities or obligations generated through the activity.*

Proposition 12.107 does not dissolve the importance of employment. Employment contracts can organize remuneration, authority, scheduling, protection, benefits, training, responsibility, and bargaining rights in consequential ways. The proposition instead prevents the employment category from becoming a proxy for the full field of labor and participation.

Table 12.23 should be read as an open analytical repertoire. The dimensions can overlap and additional forms may become relevant in particular domains. A care worker can be simultaneously an employee, household member, knowledge holder, institutional participant, and relational support provider. A software engineer can perform paid knowledge-intensive labor while also training colleagues and maintaining infrastructural knowledge that is only partly captured by measured output. A machine-learning system can perform selected tasks while depending on human design, data, maintenance, governance, and institutional responsibility. Classification should follow the mechanism relevant to the inquiry.

12.21.1 Labor as Economic Activity

Labor as economic activity concerns what is done: producing, maintaining, repairing, coordinating, caring, transporting, teaching, designing, interpreting, monitoring, cleaning, coding, administering, or otherwise contributing to an economically consequential process. Activity-level analysis is useful because the same institutional category can contain heterogeneous tasks, and similar tasks can be performed under different legal, organizational, and social relations.

Task decomposition can clarify technological substitution and complementarity. Recent automation research, for example, distinguishes the displacement of tasks from the creation of new tasks and thereby shows why technological change can reorganize labor demand without mapping neatly onto whole occupations (Acemoglu and Restrepo 2019). GRE can use such task-level distinctions where they improve empirical analysis while retaining the broader historical and relational setting in which tasks are allocated, recognized, and governed.

Activity also has temporal and embodied dimensions. Two activities that appear similar in an output measure can differ in scheduling constraints, fatigue, emotional demand, exposure to risk, need for tacit judgment, or dependence on complementary resources. Labor analysis should therefore avoid inferring the full economic significance of activity from output quantity alone. Where the inquiry concerns capabilities,

Table 12.23: Selected dimensions of labor and economic participation.

Dimension	Economic significance	Questions requiring specification
Activity	Performance of tasks, care, production, maintenance, coordination, learning, or reproduction	What is done, with what resources, under what conditions, over what time, and with what effects?
Labor relation	Organization of activity through contract, authority, reciprocity, household relation, cooperative governance, platform mediation, or other arrangements	Who sets tasks, schedules, standards, remuneration, monitoring, responsibility, and revision?
Contribution	Addition to a collective, organizational, infrastructural, epistemic, or productive process	What contribution is attributable, how is it recognized, and how are benefits and burdens distributed?
Compensation and recognition	Wage, salary, fee, share, in-kind provision, entitlement, status, or absence of explicit compensation	Which contributions receive payment or recognition, through what rules, and with what exclusions?
Care and reproduction	Maintenance and reproduction of persons, households, communities, and capabilities	Who performs care, who receives it, how are time and dependency organized, and which effects remain outside market accounting?
Knowledge-intensive work	Creation, interpretation, transmission, and application of knowledge	Where does knowledge reside, how is it shared or protected, and how are learning and tacit expertise organized?
Automated participation	Machine-performed tasks, algorithmic mediation, and AI-assisted production or coordination	Which functions are automated, who designs and controls the system, where does responsibility remain, and what complementary human activity is required?
Participation beyond employment	Governance, volunteering, commons contribution, household provision, consumption, community work, ownership, or institutional participation	What form of participation occurs and what capacities, obligations, recognition, or influence follow from it?
Differentiated participation	Uneven access to roles, voice, compensation, learning, ownership, decision power, or exit	Which dimensions differ across participants, through what mechanisms, and with what cumulative consequences?
Generative consequence	Later capacities, relations, knowledge, dependencies, identities, institutions, or possibilities produced through participation	What does participation generate over time, for whom, at what scale, and under what historical conditions?

health, learning, care, or relational continuity, these conditions can be constitutive of the economic process rather than secondary details.

12.21.2 Labor Relations

Labor relations concern the relational architecture through which activity is organized. They can include wage contracts, self-employment, household obligations, apprenticeships, cooperative membership, platform-mediated work, professional norms, public-service roles, reciprocal community arrangements, or other forms. A labor relation can specify who has authority to assign tasks, who bears risk, how compensation is determined, how performance is monitored, what protections apply, and how disagreement or exit is handled.

Classical analysis of the labor process already emphasized that production relations concern more than the physical performance of work; they also organize control, cooperation, division of labor, machinery, and appropriation (Marx 1867). Contemporary algorithmic-management research similarly shows that computational systems can participate in directing, evaluating, and disciplining work, altering how authority is exercised even when the formal employment relation remains unchanged (Kellogg et al. 2020). These literatures differ substantially in theoretical orientation, but both illustrate the analytical importance of the relation that organizes activity.

The labor relation can therefore change while the task remains similar. A driver can perform transport activity as an employee, contractor, platform participant, cooperative member, or owner-operator. The surface activity may be comparable, yet authority, income risk, asset ownership, scheduling, insurance, data access, dispute resolution, and exit conditions can differ materially. GRE should reconstruct these dimensions rather than infer the relation from the task label.

12.21.3 Labor and Contribution

Contribution concerns the relation between activity and a wider process or capacity. Labor can contribute to immediate output, maintenance of infrastructure, reproduction of capabilities, organizational memory, learning, trust, institutional continuity, or future option sets. Contribution therefore extends beyond the marginal addition to a measurable product, although quantitative productivity measures can remain useful for particular questions.

The distinction matters because contribution can be distributed and temporally delayed. A mentor's work can improve another participant's later capacity. Maintenance activity can prevent failure without producing a visible new output. Documentation can preserve organizational memory. Care can enable another person's participation in education or employment. Training can change the future distribution of knowledge. The contribution of labor may therefore be mediated through later relations and events rather than exhausted by contemporaneous output.

Contribution and labor are also non-equivalent. Some contributions do not require labor in the relevant sense, such as provision of capital, ownership rights, access to infrastructure, or institutional authorization. Conversely, labor can be performed without producing the contribution anticipated by the organization or worker. An analysis should therefore specify the mechanism connecting activity to the process whose outcome is being attributed.

Proposition 12.108 (Labor–contribution distinction). *A claim that labor contributes to an economic outcome should identify the mechanism, temporal horizon, and relational pathway connecting the activity to that outcome. Labor performed and contribution realized can diverge because of coordination failure, complementary-resource constraints, institutional conditions, delayed effects, or transformation of the surrounding configuration.*

12.21.4 Paid and Unpaid Labor

Payment is an important economic relation, yet it is not a complete criterion for labor significance. Paid labor is organized through monetary or monetizable compensation under a wide range of contractual and institutional forms. Unpaid labor can occur in households, care relations, communities, cooperatives, voluntary organizations, family enterprises, internships, open-source projects, and other settings. Some activities combine paid and unpaid components or move between them over time.

Feminist economics has shown that national accounting and conventional work categories can exclude or obscure economically consequential unpaid household and care activity (Waring 1988). Himmelweit's analysis also cautions that expanding the category of work to unpaid domestic activity requires conceptual care because the language of work carries assumptions derived from wage labor (Himmelweit 1995). Social-provisioning approaches accordingly analyze paid and unpaid activity together with well-being, care, power, and institutional conditions (Power 2004).

GRE can draw on this tradition without treating every useful or meaningful activity as labor. The analytical question is whether a specified activity contributes to an economic process in a way relevant to the inquiry and how its recognition, compensation, obligation, and distribution are organized. Absence of payment can conceal contribution; presence of payment does not by itself establish social usefulness, fair recognition, or desirable relational conditions.

12.21.5 Care Labor and Reproductive Activity

Care labor and reproductive activity concern the maintenance and reproduction of persons, relationships, households, communities, and capabilities across time. They can include feeding, cleaning, emotional support, health-related assistance, childrearing, elder care, coordination of household life, and other activities through which everyday participation becomes possible. These activities can be paid, unpaid, familial, communal, professional, institutional, or distributed across several arrangements.

Care is economically significant partly because it changes capacities and dependencies. A person's ability to learn, work, recover, travel, or participate can depend on care provided by others. Care arrangements can therefore redistribute time, opportunity, risk, and bargaining position among household or community members. The earlier analysis of households and provisioning is relevant here: care cannot be reconstructed adequately by observing only household-level income or aggregate consumption.

Care relations also contain normative and experiential dimensions that economic measurement may only partly represent. GRE should therefore avoid reducing care

to a homogeneous service unit merely because some components can be priced. At the same time, interpretive richness should not become a reason to exclude operational analysis where it is useful. Time-use measures, staffing ratios, access indicators, labor conditions, and outcome measures can contribute to inquiry while remaining partial representations of the care relation.

12.21.6 Knowledge-Intensive Labor

Knowledge-intensive labor depends substantially on the creation, interpretation, recombination, communication, or application of knowledge. Examples include research, design, teaching, diagnosis, software development, legal analysis, engineering, scientific work, management, and many forms of professional or technical practice. The category remains purpose-relative because most labor contains some knowledge component and because the boundary between routine and knowledge-intensive tasks changes with technology and organization.

Human-capital analysis provides one influential representation of acquired knowledge and skill as productive capacity (Becker 1964). Hayek's analysis of dispersed knowledge provides a different emphasis, drawing attention to the fact that economically relevant knowledge can be distributed across participants and may not be available to any single coordinating center (Hayek 1945). GRE can use both insights while keeping knowledge embedded in relational and institutional conditions: knowledge can be embodied, tacit, codified, distributed, protected, forgotten, or dependent on access to tools and communities.

Knowledge-intensive labor often generates effects beyond the immediate task. Documentation can become organizational memory; mentoring can redistribute expertise; research can create new problem framings; standards can coordinate later activity; software can become infrastructure. These effects can be difficult to attribute to individual workers because they emerge through collaborative, cumulative, or institutional processes. Contribution analysis should therefore preserve both individual activity and the relational configuration through which knowledge becomes usable.

12.21.7 Artificial Participation and Automated Work

Automated systems and artificial agents can perform tasks that participate in economic production, coordination, communication, classification, monitoring, or decision support. This participation can alter the allocation of human tasks, the organization of authority, the distribution of knowledge, and the capacities available to organizations or households. The present subsection treats artificial participation functionally and economically. It does not infer consciousness, moral status, legal personality, or independent responsibility from task performance.

Automation can substitute for selected human tasks while also creating complementary tasks, changing skill requirements, or reorganizing production (Acemoglu and Restrepo 2019). Evidence from generative-AI deployment also indicates that AI assistance can affect productivity and the distribution of performance across workers under particular task and organizational conditions (Brynjolfsson et al. 2025). These findings motivate analysis of task composition and organizational context rather than

a categorical claim that AI simply replaces or augments labor in one uniform direction.

Artificial participation should therefore be decomposed into the functions actually performed: generating text or code, ranking options, controlling machinery, matching participants, detecting patterns, maintaining schedules, monitoring performance, or mediating access. The analysis should also identify the human and institutional relations required for those functions, including data production, system design, maintenance, supervision, legal responsibility, energy and infrastructure, and organizational adoption.

Caution 12.109 (Artificial participation and subject equivalence). Functional participation in an economic process does not establish equivalence between artificial systems and human participants with respect to experience, welfare, responsibility, rights, vulnerability, or moral standing. These dimensions require separate argument and evidence. The economic analysis should specify the functional relation under study without importing broader conclusions from task performance alone.

The distributional and political-economic consequences of advanced AI require fuller treatment than this architectural section can provide. Here the relevant point is narrower: artificial systems can become components of labor and participation architectures, and their effects depend on ownership, access, complementary human capacities, organizational design, institutional rules, and the relations through which outputs are interpreted and acted upon.

12.21.8 Economic Participation beyond Employment

Economic participation extends beyond employment because subjects can contribute to and be affected by economic configurations through governance, ownership, consumption, household provision, commons management, volunteering, community activity, professional associations, platform participation, investment, taxation, public deliberation, or institutional membership. These forms differ in their relation to labor, compensation, authority, and responsibility.

Worker participation in enterprise governance provides one established example. Labor-managed-firm theory examines arrangements in which workers participate in enterprise decision-making and income distribution through institutional forms different from conventional capital-managed firms (Vanek 1970). Commons governance and cooperative institutions provide additional examples in which contribution, membership, ownership, and decision authority can be distributed through rules that do not map directly onto employment status.

Participation can also be indirect. Consumers can influence demand without governing production. Citizens can shape public economic institutions through political processes. Community members can sustain shared infrastructure through norms or voluntary contribution. Owners can exercise governance without performing operational labor. The analytical category of participation should therefore be specified by mechanism: contribution, voice, ownership, use, governance, exposure, obligation, or another relation.

12.21.9 Differentiated Participation

Economic participation is commonly differentiated across subjects and positions. Participants can differ in access to roles, compensation, information, learning, ownership, decision authority, representation, recognition, protection, bargaining power, mobility, and exit. A shared label such as employee, member, contributor, or user can therefore conceal materially different participation conditions.

Differentiation can arise through credentials, institutional categories, legal status, organizational hierarchy, network position, care responsibilities, disability, geography, language, technology, wealth, social recognition, or historically accumulated advantage. Some of these differences may be relevant to the functioning of the activity; others can reflect inherited barriers or power relations. GRE should identify the mechanism before interpreting the difference normatively.

Epistemic participation is one important dimension. Whose observations are treated as credible, whose categories become institutionalized, and whose experiential knowledge receives uptake can affect organizational and economic decisions. Work on epistemic injustice provides one relevant vocabulary for credibility and interpretive exclusion (Fricker 2007). The present analysis uses this literature selectively to show that participation can vary in epistemic influence even when formal membership is equal.

Proposition 12.110 (Participation-dimension non-equivalence). *Equality or inclusion in one participation dimension does not establish equality or inclusion in others. Analysis should specify the relevant dimensions of participation and the mechanisms connecting them before drawing conclusions about overall participation or exclusion.*

12.21.10 Generative Consequences of Participation

Participation can alter the capacities, relations, identities, knowledge, institutions, expectations, and future options of both participants and the wider configuration. These effects constitute the generative dimension of labor and participation. They can arise through learning, repeated cooperation, conflict, recognition, reputation, skill formation, organizational memory, institutional reform, network formation, technological adoption, or changes in ownership and authority.

Participation can generate capacities. Workers can acquire skills; communities can develop governance routines; organizations can accumulate knowledge; repeated collaboration can establish trust; participation in decision-making can improve understanding of institutional processes. Generative-justice scholarship provides one existing example of a framework that emphasizes the participation of value generators in the circulation and governance of generated value (Eglash 2016). GRE does not treat this or any other participation principle as universally required. Its relevance depends on the specific normative and institutional problem.

Participation can also generate dependency, exhaustion, exclusion, hierarchy, or narrowed alternatives. A worker can accumulate organization-specific skills that increase productivity while reducing outside mobility. A platform participant can gain market access while becoming dependent on ranking or interface rules. A caregiver can sustain household capabilities while losing time for independent income or edu-

cation. A volunteer community can generate common infrastructure while concentrating invisible burdens on a small number of contributors. Generativity therefore remains analytically separate from desirability.

Proposition 12.111 (Generative consequence of participation). *Where participation changes later capacities, relations, knowledge, institutional positions, dependencies, recognition, or feasible actions, those changes form part of the economic consequence of participation in addition to contemporaneous output or compensation.*

Proposition 12.111 connects labor and participation to the wider GRE programme without turning participation into a universal normative ideal. The appropriate form, depth, and distribution of participation remain historically situated questions. Some processes can require broad participation; others can legitimately rely on specialized authority, automation, representation, or temporary delegation. The analytical responsibility is to make the participation architecture visible and to trace what it generates over time.

Remark 12.112 (Revisable labor and participation categories). The categories developed in this section are provisional analytical resources. Technological change, household transformation, institutional reform, new organizational forms, and changing understandings of care, knowledge, responsibility, and artificial agency can alter what counts as labor or economically significant participation. GRE should therefore permit the categories themselves to be revised when the empirical field or the purpose of inquiry changes.

12.22 Coordination and Dependence

Coordination and dependence describe two related dimensions of economic architecture. Coordination concerns the processes through which interdependent activities, expectations, resources, decisions, and timings become sufficiently compatible for an economic process to proceed. Dependence concerns the extent to which a subject or configuration relies on resources, capacities, knowledge, infrastructure, permissions, or actions that are located partly outside its immediate control. This section develops these dimensions together because coordination arrangements often redistribute dependence, while dependence conditions the feasible forms of coordination. Its objective is to provide a comparative vocabulary for hierarchical, market, network, cooperative, and algorithmic coordination and for resource, capability, and epistemic dependence. The discussion is conceptual and comparative, drawing selectively on organizational economics, network analysis, institutional research, collective-action scholarship, resource-dependence theory, and studies of algorithmic control. Table 12.24 summarizes the principal dimensions.

Coordination is broader than centralized direction. Prices, contracts, routines, standards, norms, interfaces, reciprocity, deliberation, professional conventions, infrastructures, and algorithmic systems can each contribute to the alignment of interdependent activity. Classical work on the firm emphasized that economic coordination can occur through organizational authority as well as through the price mechanism (Coase 1937; Williamson 2000). Work on distributed knowledge emphasized the coordinative role of prices where relevant knowledge is dispersed (Hayek

1945). Network and institutional research further demonstrates forms of coordination organized through recurrent relations, reciprocity, trust, collaboration, and shared rules that cannot be represented adequately by a simple market–hierarchy dichotomy (Powell 1990; Granovetter 1985; Ostrom 1990).

Definition 12.113 (Economic coordination). For a specified economic process, *economic coordination* is the historically situated organization of interdependent activities, decisions, expectations, resources, or timings such that participants or components can achieve a degree of mutual compatibility relevant to that process. A coordination analysis should specify what is being coordinated, through which mechanisms, among which positions, over what horizon, and with what consequences for capacity, burden, dependence, and revision.

Definition 12.114 (Economic dependence). For a specified subject or configuration, *economic dependence* is a relation in which the maintenance or exercise of a relevant capacity depends materially on resources, actions, knowledge, infrastructures, permissions, recognition, or complementary capacities controlled, supplied, mediated, or sustained elsewhere. Dependence is therefore relative to the capacity, time horizon, available alternatives, and relational position under examination.

Definitions 12.113 and 12.114 keep coordination and dependence analytically separate. A market transaction can coordinate exchange while leaving participants relatively substitutable. A tightly integrated production process can coordinate effectively while creating strong mutual dependence among specialized participants. A household can depend on public infrastructure without that infrastructure actively coordinating household decisions. The relevant analytical task is therefore to identify both the coordination mechanism and the dependence structure where each matters.

Proposition 12.115 (Coordination–dependence non-equivalence). *The presence, intensity, or effectiveness of coordination does not by itself determine the presence, direction, or asymmetry of dependence. Coordination and dependence should be specified through their own mechanisms before conclusions are drawn about resilience, autonomy, power, efficiency, or normative desirability.*

Table 12.24 is an open analytical repertoire rather than a complete taxonomy. Real configurations commonly combine several forms. A platform can coordinate market exchange through prices while using algorithms to rank participants and organizational authority to set platform rules. A hospital can combine professional hierarchy, team coordination, market procurement, public regulation, and dependence on specialized infrastructures. A commons can coordinate through collective rules while remaining dependent on external legal recognition, financing, or ecological conditions. The appropriate decomposition therefore follows the mechanisms relevant to the inquiry.

12.22.1 Hierarchical Coordination

Hierarchical coordination organizes interdependent activity through differentiated roles, authority, reporting relations, internal rules, planning routines, and procedures for allocating tasks and resources. Its analytical significance arises where some decisions are coordinated within an organization or authority structure rather than renegotiated through separate market transactions. Coase’s analysis of the

Table 12.24: Selected dimensions of coordination and dependence in economic architecture.

Dimension	Principal coordination or dependence mechanism	Questions requiring specification
Hierarchical coordination	Authority, roles, routines, reporting, planning, supervision, and internal allocation	Who can direct whom, through which roles and procedures, with what discretion and revision?
Market coordination	Prices, bids, contracts, substitution, exchange opportunities, and expectations	Which information is represented, which conditions remain outside prices, and who can effectively participate?
Network coordination	Recurrent ties, reputation, reciprocity, brokerage, standards, and distributed communication	Which relations carry coordination, how stable are they, and where are bottlenecks or dependencies located?
Cooperative coordination	Shared rules, mutual monitoring, deliberation, contribution, reciprocity, and collective governance	How are common tasks, obligations, disputes, benefits, and revisions organized among participants?
Algorithmic coordination	Ranking, matching, scheduling, recommendation, automated allocation, monitoring, and rule execution	Which objectives and data are encoded, who can revise the system, and how do outputs alter later behavior?
Resource dependence	Reliance on consequential material, financial, infrastructural, institutional, or relational resources	How substitutable is the resource, who controls access, and what happens under interruption?
Capability dependence	Reliance on complementary capacities held by other subjects, organizations, institutions, or infrastructures	Which activity becomes infeasible or degraded when the complementary capacity is absent?
Epistemic dependence	Reliance on knowledge, interpretation, classification, expertise, data, or credibility supplied elsewhere	Which judgments depend on whom, how can claims be checked, and where can epistemic bottlenecks arise?
Dependence asymmetry	Reciprocal reliance with different alternatives, switching costs, control positions, or temporal exposure	How are dependence and alternatives distributed across participants and over time?
Dependence transformation	Diversification, substitution, integration, standardization, portability, learning, mutualization, or institutional change	Which dependence is reduced, relocated, deepened, or newly created by the transformation?

firm identified the costs of using the price mechanism as one reason economic activity can be organized through firms, while later institutional economics developed governance structures as an important object of comparative analysis (Coase 1937; Williamson 2000).

Hierarchy can reduce some coordination burdens by establishing recognized decision rights, shared routines, common records, and procedures for resolving conflicts. It can also create informational distance, bottlenecks, dependence on superior posi-

tions, and reduced local discretion. These consequences vary with the depth of hierarchy, delegation arrangements, expertise distribution, communication channels, and the reversibility of decisions.

Hierarchical coordination should therefore be reconstructed through actual decision relations rather than inferred from an organizational chart alone. Formal authority can be weakly exercised, informally redistributed, technically constrained, or dependent on specialized subordinates. Conversely, actors without senior formal titles can exercise consequential coordination through expertise, control of infrastructure, agenda-setting, or procedural knowledge. The relevant object is the enacted architecture of coordination.

Remark 12.116 (Hierarchy as a coordination form). Hierarchical coordination is one possible response to interdependence. Its presence does not establish superiority over market, network, cooperative, or hybrid forms, and its absence does not imply decentralized autonomy. Comparative evaluation requires specification of the task, uncertainty, knowledge distribution, transaction conditions, accountability structure, and historical setting.

12.22.2 Market Coordination

Market coordination organizes activity through exchange opportunities, prices, bids, contracts, expectations, substitution, and the responses of participants to changing relative conditions. Hayek's account of dispersed knowledge emphasized the capacity of price movements to communicate selected information relevant to decentralized adjustment when knowledge is distributed across many actors (Hayek 1945). Within GRE, this insight is retained as one important coordination mechanism while the surrounding institutional and relational conditions remain visible.

Prices can coordinate without representing the entire economic field. They may communicate scarcity, demand, or opportunity under specified market institutions while leaving unrepresented such factors as unpaid care, externalized costs, unequal access, bargaining constraints, legal entitlements, ecological conditions, or distributional consequences. Section-level analysis should therefore ask what the price mechanism coordinates effectively, which participants can respond, and which relevant relations remain outside the represented signal.

Market coordination also depends on infrastructures that make exchange possible: property and contract rules, payment systems, standards, information channels, logistics, dispute resolution, and expectations about future conduct. These conditions can themselves be organized through hierarchical, network, cooperative, or public mechanisms. Market coordination is therefore relationally embedded rather than analytically self-sufficient (Granovetter 1985).

12.22.3 Network Coordination

Network coordination operates through recurrent relations among actors or organizations whose activities are connected without being integrated into one hierarchy or reduced to isolated market transactions. Reciprocal communication, reputation, trust, repeated exchange, joint problem-solving, and relational continuity can

coordinate activity across organizational boundaries. Powell's analysis of network forms highlights arrangements in which reciprocal communication and relational exchange differ from both market and hierarchical governance (Powell 1990).

Network coordination can be especially important where knowledge is distributed, tasks are complementary, adaptation is frequent, or collaboration depends on relation-specific learning. Interorganizational innovation research provides one example in which learning and collaboration occur through networks spanning organizational boundaries (Powell et al. 1996). Network position can consequently affect access to information, partners, resources, and future coordination opportunities.

The same architecture can create dependence. A focal actor can rely heavily on a broker, standard-setter, dominant supplier, trusted partner, or dense cluster of specialized relations. Network redundancy can reduce some vulnerabilities, while relation-specific learning can increase switching costs. Network coordination should therefore be analyzed together with topology, alternatives, multiplex relations, and the distribution of brokerage or gatekeeping positions.

12.22.4 Cooperative Coordination

Cooperative coordination organizes interdependent activity through shared rules, reciprocal contribution, deliberation, mutual monitoring, collective governance, or other arrangements in which participants contribute directly to coordination rather than relying exclusively on market exchange or centralized command. Commons research demonstrates that groups can develop durable rule systems for managing shared resources under some conditions, while also documenting failures and considerable institutional diversity (Ostrom 1990; Ostrom 2005).

Cooperative coordination can include member-owned organizations, peer production, commons governance, professional communities, mutual-aid arrangements, and collaborative projects. Large-scale peer production provides one example in which distributed contributors can coordinate through modular tasks, shared technical infrastructures, and community governance without reproducing a conventional firm structure (Benkler 2002). These arrangements vary greatly in membership, authority, contribution rules, sanctioning, representation, and ownership.

Cooperation does not imply equality, consensus, or absence of conflict. Cooperative arrangements can contain differentiated expertise, unequal contribution, informal hierarchy, exclusion, concentrated agenda-setting, or dependency on external infrastructure. Their analysis should therefore specify the actual governance and contribution relations rather than infer normative qualities from the cooperative label.

12.22.5 Algorithmic Coordination

Algorithmic coordination uses computational systems to mediate, sequence, rank, match, allocate, recommend, schedule, monitor, or otherwise structure interdependent activity. Such systems can operate within firms, markets, platforms, public institutions, logistics networks, households, or mixed configurations. Algorithmic coord-

dination is therefore a mechanism that can be embedded in several broader coordination forms rather than a mutually exclusive alternative to hierarchy, markets, or networks.

Algorithmic systems can make coordination rapid and scalable where decisions depend on large volumes of data or repeated allocation. They can also encode objectives, classifications, constraints, and priority rules that are difficult for participants to observe or contest. Research on algorithms at work shows that computational systems can become mechanisms of direction, evaluation, and discipline within organizational relations (Kellogg et al. 2020). Platform research likewise illustrates how matching and pricing systems can coordinate participation across multiple sides (Rochet and Tirole 2003).

GRE should therefore distinguish the computational procedure from the institutional architecture within which it operates. Relevant questions include who selects objectives, which data enter the system, what uncertainty is represented, who can inspect or revise the rules, how exceptions are handled, where responsibility remains, and whether participants possess meaningful alternatives. An algorithmic output can also become a performative input to later behavior when rankings, recommendations, or forecasts alter the field on which subsequent calculations depend.

Caution 12.117 (Algorithmic coordination and closure). Operational consistency or predictive performance does not establish that an algorithmic coordination system captures every economically relevant relation. The system can coordinate effectively with respect to selected objectives while leaving unrepresented burdens, values, external effects, informal knowledge, or distributional consequences. Its analytical assessment should therefore include both encoded and omitted dimensions where they materially affect the inquiry.

12.22.6 Resource Dependence

Resource dependence arises when a relevant capacity relies on access to material, financial, infrastructural, institutional, informational, or relational resources controlled or mediated elsewhere. Resource-dependence theory made this relation central to organizational analysis by emphasizing organizations' dependence on external environments for consequential resources and the strategies through which organizations respond to external constraint and uncertainty (Pfeffer and Salancik 1978).

Within GRE, resource dependence is defined relative to a specified capacity. Dependence on electricity, credit, specialized components, land, legal authorization, computing infrastructure, transport, data, reputation, or trusted partners becomes analytically important when interruption or alteration materially changes what the subject or configuration can do. The same resource can be critical for one process and substitutable for another.

Resource dependence is therefore sensitive to alternatives, switching costs, redundancy, timing, concentration of supply, contractual arrangements, inventories, portability, and the capacity to reorganize production. A subject can possess large nominal resources while remaining strongly dependent on one complementary resource that cannot be replaced within the relevant horizon. Resource abundance and low dependence are consequently distinct properties.

Proposition 12.118 (Capacity-relative resource dependence). *Resource dependence should be attributed relative to a specified capacity, resource relation, time horizon, and set of feasible alternatives. The quantity or value of the resource alone is insufficient to determine the degree or direction of dependence.*

12.22.7 Capability Dependence

Capability dependence concerns reliance on complementary abilities that reside in other subjects, organizations, institutions, infrastructures, or coordinated configurations. A hospital may possess buildings and equipment while depending on specialist clinical capacity. A manufacturer may own machinery while depending on external design expertise, maintenance capability, certification, or logistics. A household can possess financial resources while depending on care, language, mobility, or institutional-navigation capacities held by others.

This distinction extends the resource–capacity non-equivalence developed earlier in the chapter. Resources become effective through conversion and complementary capacities. Capability-oriented economic analysis similarly emphasizes that resources and commodities do not map mechanically onto what persons are effectively able to do or be (Sen 1985; Sen 1999). GRE uses the distinction here descriptively: the object is the relational location of a capacity required for a specified process.

Capability dependence can be mutual. Specialized participants can each possess capacities that become productive only through combination. Mutual complementarity can support cooperation and specialization while also increasing vulnerability to disruption. The relevant inquiry should therefore identify both the capacity generated by coordination and the dependence structure created through specialization.

12.22.8 Epistemic Dependence

Epistemic dependence arises when economically consequential judgment or action relies on knowledge, interpretation, classification, credibility, expertise, data, or inference supplied by others. Complex economies make some degree of epistemic dependence pervasive because participants cannot independently reproduce the knowledge required for every technical, legal, financial, medical, scientific, organizational, or infrastructural decision.

Epistemic dependence can be productive. Specialization allows complex knowledge to be developed and used without requiring each participant to master the full epistemic chain. It can also create vulnerabilities when expertise is opaque, alternatives are absent, provenance is weak, verification is costly, or one intermediary controls classification and interpretation. These problems become especially consequential where epistemic authority is linked to resource allocation, eligibility, credit, employment, risk classification, or public decision-making.

The analysis should therefore distinguish dependence on information from dependence on interpretation and from dependence on authority to validate a claim. A subject can possess raw data while depending on another actor for technical interpretation; an organization can possess expertise while depending on a regulator's certification; a decision maker can receive multiple expert assessments while depending

on institutional procedures for determining which assessment receives uptake.

Remark 12.119 (Epistemic dependence and verification). Epistemic dependence does not require the dependent subject to reproduce the entire knowledge process independently. The relevant practical question is whether the dependence is accompanied by suitable forms of provenance, contestability, cross-checking, accountability, or alternative expertise for the stakes and uncertainty involved.

12.22.9 Mutual and Asymmetric Dependence

Economic dependence can be mutual while remaining unequal in degree, timing, alternatives, or consequences. Two firms can rely on each other while one possesses more substitute partners. An employer can depend on specialized workers while workers depend more immediately on income. A platform can depend on participant activity while individual participants depend more strongly on access to the platform. A household and a care provider can be mutually reliant while differing substantially in exit options and exposure to interruption.

Mutual dependence can support cooperation because participants possess reasons to maintain a relation, invest in coordination, share information, or develop joint capacity. It can also become fragile where the forms of dependence are differently timed or where one party can absorb interruption more easily. Dependence should therefore be decomposed across dimensions such as resource criticality, substitutability, switching cost, time to replacement, legal protection, information, outside options, and capacity to delay.

Asymmetric dependence can contribute to power, but the relation should be established through mechanism rather than treated as a synonym for power. The next analytical level concerns how asymmetries in resources, capacities, information, institutions, time, and relational position are converted into durable differences in influence or constraint. The present section remains focused on the dependence architecture itself.

Proposition 12.120 (Dimension-specific dependence asymmetry). *Dependence asymmetry is dimension-specific. Mutual dependence in one resource, capacity, or time horizon can coexist with strong asymmetry in another. Aggregate labels such as “interdependent” or “dependent” should therefore be decomposed when the distribution of alternatives, switching costs, exposure, or control is consequential to the inquiry.*

12.22.10 Transformation of Dependence Relations

Dependence relations can change through diversification, substitution, vertical integration, standardization, interoperability, portability, redundancy, inventories, learning, technological change, institutional reform, collective organization, mutualization, regulation, or the creation of new alternatives. These transformations can reduce reliance on one relation while relocating dependence to another part of the configuration.

Diversifying suppliers can reduce concentration while increasing coordination complexity. Vertical integration can reduce dependence on an external supplier while increasing dependence on internal managerial, financial, or technical capaci-

ties. Standardization and interoperability can lower switching costs while creating dependence on standard-setting institutions or shared infrastructures. Automation can reduce dependence on selected human tasks while increasing dependence on data, computation, energy, software maintenance, or specialized technical expertise. Collective organization can reduce isolated actors' dependence on a dominant counterparty while creating new internal governance requirements.

Dependence transformation should therefore be evaluated as relational reconfiguration. The relevant question is not simply whether dependence decreased, but which capacities became more or less dependent on which actors, infrastructures, institutions, or histories, over what horizon, and with what new vulnerabilities or options.

Proposition 12.121 (Dependence reconfiguration). *An intervention that weakens one dependence relation can create, relocate, or deepen other dependence relations. Analysis of dependence transformation should therefore trace the configuration before and after the change rather than infer increased autonomy from the reduction of a single dependency.*

Proposition 12.121 also clarifies why coordination and dependence should be studied together. New coordination mechanisms can expand collective capacity while redistributing reliance, switching costs, knowledge concentration, and exposure to interruption. The economic significance of coordination therefore includes both what coordinated activity makes possible and the dependence architecture through which those possibilities are sustained.

Remark 12.122 (Revisable coordination and dependence categories). The categories developed in this section are provisional analytical resources. New organizational forms, digital infrastructures, artificial agents, institutional arrangements, and historical conditions can produce coordination and dependence mechanisms that fit these categories only partially. GRE should permit the categories and their combinations to be revised when the empirical field requires a different representation.

12.23 Economic Asymmetry

Economic asymmetry concerns differences in economically consequential positions that arise within relational configurations. Such differences may concern resources, capabilities, information, epistemic standing, relational alternatives, institutional positions, timing, exposure, or other dimensions. This section develops asymmetry as a descriptive and explanatory category within the relational architecture of economic systems. Its objective is to distinguish several recurrent forms, examine how asymmetries can be converted across dimensions, and identify mechanisms through which they can persist or change. The discussion is conceptual and comparative. It draws selectively on capability analysis, distributed-knowledge arguments, institutional economics, resource-dependence research, and studies of asymmetric governance relations while keeping normative evaluation and power analysis analytically separate (Sen 1985; Sen 1992; Hayek 1945; North 1990; Pfeffer and Salancik 1978; Gereffi et al. 2005). Table 12.25 summarizes the principal dimensions developed here.

Asymmetry is relational and dimension-specific. Two subjects can occupy similar

positions in one dimension and markedly different positions in another. A worker and employer may have comparable technical knowledge while differing in authority, asset ownership, liquidity, or exit alternatives. Two firms can hold similar financial resources while differing sharply in regulatory access, information, technical standards, or bargaining alternatives. Aggregate labels such as “advantaged” and “disadvantaged” can therefore conceal the mechanisms through which a particular difference becomes economically consequential.

Definition 12.123 (Economic asymmetry). For a specified economic relation or configuration, *economic asymmetry* is a difference between positions in an economically consequential dimension whose effects depend on the surrounding relational, institutional, temporal, and historical conditions. An asymmetry analysis should identify the relevant dimension, the positions being compared, the mechanism through which the difference matters, the scale and horizon of analysis, and the conditions under which the asymmetry can change.

Definition 12.123 treats asymmetry as more specific than difference alone. Differences become analytically important when they affect capacities, feasible actions, exposure, bargaining alternatives, access, recognition, expectations, or later relation formation. The existence of such a difference does not by itself determine whether it is efficient, harmful, unjust, legitimate, temporary, or durable. Those evaluations require additional normative and empirical premises.

Proposition 12.124 (Dimension-specific asymmetry). *Economic asymmetry should be attributed to specified dimensions and mechanisms. Similarity in one dimension does not establish symmetry in others, and asymmetry in one dimension does not establish a general ordering of the subjects or configurations involved.*

Table 12.25 is an open analytical repertoire rather than a complete taxonomy. A single economic relation can contain several asymmetries at once, and the significance of each can change over time. The analytical task is therefore to identify the differences that matter for the problem under study and to reconstruct their interactions without presuming a single master dimension.

12.23.1 Resource Asymmetry

Resource asymmetry concerns differences in effective command over resources relevant to an economic process. The resource categories developed in Section 12.16 include material, financial, temporal, spatial, informational, knowledge, attentional, infrastructural, institutional-access, and relational resources. Resource asymmetry therefore extends beyond differences in wealth or income. Subjects can possess comparable financial resources while differing materially in time, infrastructure, credentials, social relations, or access to institutions.

The economic significance of resource asymmetry depends on conversion conditions. A nominally scarce resource can have limited effect where substitutes are abundant, while a modest difference can become consequential where the resource is indispensable, difficult to replace, or complementary to other capacities. Resource-dependence analysis is relevant here because organizations can become constrained by external control over consequential resources, especially where alternatives are limited (Pfeffer and Salancik 1978).

Table 12.25: Selected dimensions of economic asymmetry and their analytical questions.

Dimension	Illustrative asymmetry	Questions requiring specification
Resource	Unequal command over material, financial, temporal, spatial, infrastructural, or relational resources	Which resource matters for which capacity, how accessible and substitutable is it, and over what horizon?
Capability	Different effective abilities to act, produce, learn, negotiate, coordinate, adapt, or exit	Which conversion conditions translate resources and relations into effective capacity?
Information	Unequal possession, timing, quality, granularity, or accessibility of economically relevant information	Who knows what, when, with what reliability, and how does the difference alter action or exchange?
Epistemic	Different capacities to interpret, validate, classify, model, explain, or establish credible knowledge	Which position can make sense of evidence, challenge representations, or define accepted knowledge?
Relational	Different alternatives, network positions, dependencies, access channels, or replacement possibilities	Which relations provide options, brokerage, support, or vulnerability, and how substitutable are they?
Institutional	Different rights, statuses, procedural access, recognition, rule-setting positions, or enforcement exposure	Which institutional arrangements create or stabilize the difference, and how revisable are they?
Temporal	Different waiting capacity, urgency, sequencing position, exposure to delay, or control over timing	Who can wait, accelerate, postpone, or impose timing on others, and what future options are affected?
Conversion	Capacity to transform one asymmetry into another, such as resources into expertise, access, or control	Which conversion mechanism operates, with what losses, delays, complementarities, and barriers?
Persistence	Reproduction of an asymmetry through cumulative advantage, path dependence, institutionalization, or recurrent conversion	Which mechanism reproduces the difference, and which events could weaken, redirect, or reverse it?

Resource asymmetry should also be separated from resource inequality measured at one moment. Timing, reliability, liquidity, location, enforceability, and future access can make two equal nominal stocks generate different practical positions. A subject with a smaller but reliable resource flow can sometimes possess greater effective security than another with a larger but highly volatile or inaccessible stock.

Remark 12.125 (Resource asymmetry and practical command). Resource asymmetry is most informative when the analysis states the capacity for which the resource matters and the conditions under which it can be mobilized. Nominal holdings alone can be an incomplete proxy for practical command.

12.23.2 Capability Asymmetry

Capability asymmetry concerns differences in what subjects or configurations can effectively do under their existing resources, relations, institutions, and histories. It therefore builds on the resource–capacity distinction developed in Section 12.17. Capability-oriented economic reasoning has long emphasized that similar resources can yield different substantive opportunities because conversion conditions differ across persons and environments (Sen 1985; Sen 1992).

Within GRE, capability asymmetry can concern production, learning, coordination, interpretation, negotiation, innovation, mobility, adaptation, resistance to interruption, or exit. Such asymmetries can exist between individuals, households, firms, public institutions, communities, platforms, or other configurations. Their significance depends on which capability is relevant to the process being analyzed.

Capability differences can also be relationally generated. Specialized infrastructure, organizational routines, legal recognition, accumulated trust, complementary expertise, or established standards can enable one participant to exercise a capacity that another cannot reproduce independently. This does not imply that the capacity belongs exclusively to one entity; it may be distributed across a wider configuration.

Proposition 12.126 (Resource–capability asymmetry non-equivalence). *Differences in resources do not determine differences in effective capability without specifying the conversion conditions connecting resources to action. Capability asymmetry can therefore be greater, smaller, or differently structured than the resource asymmetry observed at the same moment.*

12.23.3 Information Asymmetry

Information asymmetry concerns differences in access to economically relevant information, including its timing, precision, granularity, reliability, or interpretability. Economic coordination commonly occurs under dispersed and incomplete knowledge, so information differences are a normal feature of many economic systems rather than an exceptional disturbance (Hayek 1945). The relevant question is which differences affect decisions, expectations, exchange conditions, monitoring, or later opportunities.

Information asymmetry can arise through specialization, privacy, proprietary control, unequal observation, technical systems, organizational boundaries, timing, or strategic disclosure. It can also be produced by institutional classifications and reporting procedures that make some states visible to particular actors while leaving others opaque. The same informational difference can have different consequences depending on whether it can be verified, shared, inferred, substituted, or challenged.

Information quantity is an incomplete measure of informational position. Access to large datasets can coexist with poor relevance, weak provenance, delayed observation, or inadequate contextual interpretation. Conversely, a locally situated actor can possess narrow but highly consequential information unavailable to a larger organization. Information asymmetry should therefore be reconstructed through the decision or relation in which the information matters.

12.23.4 Epistemic Asymmetry

Epistemic asymmetry is broader than informational asymmetry. It concerns differences in the capacities and recognized positions through which information is interpreted, validated, classified, modeled, communicated, or accepted as credible knowledge. Two actors may possess the same data while differing in technical expertise, conceptual frameworks, institutional authority, interpretive resources, or the ability to contest an established representation.

Epistemic asymmetry can therefore arise through expertise, education, professional certification, data infrastructure, model access, language, institutional credibility, or control over classificatory procedures. It can also be distributed: one actor may possess domain knowledge, another statistical expertise, and another procedural or local knowledge. The epistemic structure of an economic process can thus involve complementarities as well as inequalities.

The distinction matters because decisions can depend on who is authorized or practically able to define the relevant state of the system. Credit ratings, audits, technical certifications, eligibility classifications, forecasts, and platform metrics can shape action when other participants depend on the institutions or systems that produce them. Where such representations become performative, epistemic asymmetry can alter the relational field as well as describe it.

Remark 12.127 (Epistemic asymmetry and epistemic dependence). Epistemic asymmetry and epistemic dependence are related but distinct. An actor can know less than another without depending on that actor's judgment, while strong dependence can arise where one actor's interpretation or certification is difficult to replace even if informational differences are modest.

12.23.5 Relational Asymmetry

Relational asymmetry concerns differences in positions within economic relations and relational configurations. Relevant dimensions can include alternative partners, brokerage positions, switching costs, dependency, access channels, reputation, support relations, contractual options, or the ability to coordinate with others. The same nominal resource endowment can generate different practical positions when relational alternatives differ.

A bilateral relation can become asymmetric where one participant can replace the other at low cost while the reverse is difficult. A network can generate asymmetry where one subject occupies a bridging or gatekeeping position connecting otherwise separated participants. An organization can produce asymmetry through differentiated authority, reporting, or access to decision processes. These mechanisms should be specified separately because they imply different possibilities for change.

Relational asymmetry is also dynamic. A relation that initially provides mutual benefit can generate accumulated specialization, switching costs, shared infrastructure, or reputational investment that later changes the parties' alternatives. Conversely, new standards, intermediaries, networks, or institutions can create substitutes and reduce an earlier asymmetry. The relevant object is therefore the evolving relation among positions rather than a fixed attribute of either party.

12.23.6 Institutional Asymmetry

Institutional asymmetry concerns differentiated positions created or stabilized through rules, legal statuses, administrative procedures, classifications, recognition, enforcement, and access to institutional channels. Institutions can assign different rights, duties, liabilities, procedural opportunities, evidential burdens, or powers to different categories of participant. These differences may serve coordination, protection, specialization, representation, or other purposes, while their effects remain dependent on the surrounding historical and normative context.

Institutional asymmetry can persist even where formal rules use symmetrical language. Differences in information, legal assistance, administrative capacity, documentation, geographic access, recognition, or enforcement exposure can produce unequal effective positions under the same nominal rule. Institutional analysis therefore benefits from distinguishing written rules from enacted and practically accessible institutional relations (North 1990).

Institutions can also alter other asymmetries. Public infrastructure, procedural protections, standardization, portability, social insurance, collective bargaining arrangements, or access rules may reduce some resource or relational asymmetries. Licensing, classification, exclusivity, procedural complexity, or differential enforcement can increase others. The direction and magnitude of the effect remain empirical questions.

12.23.7 Temporal Asymmetry

Temporal asymmetry concerns differences in the capacity to wait, accelerate, postpone, synchronize, commit, recover, or impose timing within an economic process. Time is therefore relevant as a resource and as a relational position. A participant with greater liquidity may be able to wait for favorable terms; a debtor facing an imminent deadline may accept conditions that would be unattractive under a longer horizon; an organization controlling schedules or queues may shape others' feasible actions through timing alone.

Temporal asymmetry can also arise through information arrival and decision speed. One actor may observe changes earlier, update models faster, execute transactions more quickly, or absorb delay more easily. These advantages can be transient, recurrent, or institutionally stabilized. Their consequences depend on the tempo of the process and on whether delayed action can be recovered later.

Historical sequencing adds a further dimension. Early access to infrastructure, standards, networks, or institutional recognition can create cumulative advantages even after later participants obtain formally similar access. Path-dependent adoption and increasing returns provide established mechanisms through which early sequences can remain economically consequential (Arthur 1989). Temporal asymmetry therefore includes both immediate timing differences and historically inherited positional differences.

Remark 12.128 (Temporal position and waiting capacity). Temporal asymmetry is especially important where delay changes bargaining alternatives, resource depletion, legal status, learning opportunities, or access to future options. Equal calendar time

does not imply equal capacity to bear delay.

12.23.8 Asymmetry Conversion

Asymmetries can be converted across dimensions. Financial resources can finance expertise, infrastructure, legal representation, or waiting capacity. Epistemic advantages can improve access to resources or institutional procedures. Relational positions can provide information, reputation, coordination opportunities, or preferential access. Institutional standing can stabilize control over resources or improve the credibility of claims. Capability differences can generate later resource or relational differences through repeated performance and selection.

Conversion is conditional and can be asymmetric, lossy, delayed, or reversible. It depends on institutions, technologies, norms, complementary resources, timing, and relational position: resources may fail to yield epistemic authority without credibility, knowledge may have little effect without decision access, and institutional status may weaken where enforcement is limited.

For GRE, asymmetry conversion is analytically important because a modest difference in one dimension can become consequential when it opens pathways into several others. Conversely, policies or organizational changes that equalize one visible dimension can leave the wider configuration largely unchanged if conversion mechanisms remain asymmetric.

Proposition 12.129 (Situated asymmetry conversion). *Conversion of asymmetry across dimensions depends on identifiable relational and institutional mechanisms. The presence of an advantage in one dimension does not establish its convertibility into another, and successful conversion in one historical configuration need not transport unchanged to another.*

12.23.9 Persistent Asymmetry

Persistent asymmetry concerns differences reproduced across time through recurrent mechanisms such as cumulative returns, path dependence, institutionalization, inheritance, network position, learning, standards, resource accumulation, dependency, or repeated conversion across dimensions. Persistence can survive turnover in the actors occupying particular positions when the reproducing mechanism is organizational or institutional.

Persistence is distinct from permanence. Economic asymmetries can weaken, intensify, migrate across dimensions, or disappear as technologies, institutions, networks, or collective capacities change; similar measured differences can also be sustained by changing mechanisms. Their normative standing remains open: differentiated roles may support coordination, while other asymmetries may generate vulnerability, exclusion, concentration, or restricted alternatives.

Mechanism-specific persistence is therefore the operative analytical claim: repeated observation of a similar distribution does not identify the process reproducing it, and recurrent conversion, institutional reproduction, cumulative advantage, relational dependence, and other mechanisms imply different possibilities for transformation.

12.24 Symbolized Economic Relations

Economic relations are frequently mediated by symbols, records, categories, measures, and formal representations. This section develops symbolized economic relations as a component of economic architecture: legal statuses, administrative categories, accounts, statistics, contracts, prices, credit records, and digital representations can render selected relations visible, comparable, actionable, and transferable across institutional settings. The objective is to distinguish the economic relation from its representation while examining the conditions under which representations acquire causal significance. The discussion proceeds comparatively across major representational forms, then examines mismatch, revisability, performativity, and epistemic events. The method is interpretive and institutional, with ontological restraint: representations are treated as historically situated interfaces to economic relations rather than as complete replicas of the relations they describe. Work on quantification, classification, and commensuration provides established reasons to examine how representational practices shape visibility and comparability while preserving the distinction between measurement and the underlying object (Porter 1995; Desrosières 1998; Espeland and Stevens 1998; Bowker and Star 1999).

Definition 12.130 (Symbolized economic relation). A *symbolized economic relation* is an economic relation whose recognition, coordination, evaluation, transfer, enforcement, or practical accessibility is mediated in part through a symbolic or representational form. The representation may record an existing relation, constitute an institutionally recognized position, coordinate expectations, or participate in changing later economic behavior.

The definition does not require a strong distinction between a fully formed “real” relation and a merely secondary symbol. Some relations, including many legal, monetary, contractual, accounting, and administrative positions, are partly constituted through recognized symbolic forms. At the same time, institutional recognition does not imply that the symbolic form exhausts the wider history, dependence, capability, or relational consequences associated with the position. The analytical task is therefore to identify what the representation makes actionable, what it omits, and how it enters the subsequent evolution of the economic field.

Table 12.26 summarizes the principal representational forms developed in this section. The list is illustrative. A single economic relation can be represented simultaneously through several forms, and the same representational form can support different mechanisms in different institutional settings.

12.24.1 Legal Representation

Legal representation gives selected economic relations institutionally recognized form through legal categories, titles, rights, duties, powers, liabilities, immunities, procedures, and remedies. A property title, corporate status, employment classification, security interest, license, entitlement, fiduciary position, or legal personality can make a relation legible to courts, administrators, counterparties, and other institutions. Hohfeld’s analytical decomposition of legal positions is useful here because it shows that legal relations can be represented through differentiated correlatives

Table 12.26: Illustrative forms of symbolized economic relations and their analytical roles.

Form	Typical represented object	Possible economic role	Analytical caution
Legal	rights, duties, powers, liabilities, status	recognition, enforceability, transfer, authority	legal position may differ from practical control or access
Administrative	eligibility, category, compliance status, identity	allocation, monitoring, authorization, exclusion	categories can simplify heterogeneous histories
Accounting	assets, liabilities, flows, costs, revenues	organizational memory, comparison, control, reporting	recorded boundary and valuation rules are constructed
Statistical	populations, sectors, aggregates, distributions	comparison, policy observation, model calibration	aggregation can hide internal heterogeneity
Contractual	commitments, contingencies, permissions, remedies	expectation, coordination, obligation, risk allocation	written terms may differ from enacted relations
Price	exchange ratios and market quotations	coordination, comparison, signaling, settlement	price does not uniquely identify underlying relations
Credit	claims, repayment histories, ratings, limits	deferred exchange, screening, access, future obligation	representation can affect the capacity it purports to assess
Digital	identities, scores, logs, tokens, rankings, platform states	automation, portability, filtering, access control	technical encoding can concentrate classificatory power

rather than through a single undifferentiated idea of a “right” (Hohfeld 1919).

Legal representation can be constitutive as well as descriptive. Recognition of ownership can change transferability, exclusion, liability, financing possibilities, inheritance, or the availability of remedies. Recognition of an organization as a legal person can stabilize contracts and obligations across membership turnover. Classification of a worker, asset, creditor, or beneficiary can alter the rights and duties attached to the position. The legal representation therefore enters the economic relation through institutional consequences.

The effective relation can nevertheless differ from the legal representation. Formal ownership may coexist with weak practical control; legal entitlement may be difficult to exercise; a formally independent contractor may occupy a relation with strong practical dependence; and informal claims may remain economically consequential even where formal recognition is limited. GRE therefore treats legal form as one important layer of relational architecture whose causal significance depends on enactment, enforcement, access, and interaction with other relations.

Remark 12.131 (Legal representation and relational remainder). A legal representation can stabilize selected dimensions of a relation while leaving other dimensions

outside its formal description. Historical dependence, trust, tacit obligations, informal authority, social recognition, and practical switching costs can remain economically consequential after the legal position has been specified.

12.24.2 Administrative Representation

Administrative representation operationalizes economic relations through categories, records, identifiers, eligibility determinations, procedural statuses, compliance codes, files, registries, and other forms used by organizations and public authorities. These representations often translate general institutional rules into determinate decisions about who or what is recognized, counted, monitored, authorized, paid, taxed, inspected, sanctioned, or granted access.

Administrative representations depend on classification. Classification can make heterogeneous cases comparable enough for recurrent decision processes, but it also selects which distinctions become institutionally visible. Work on classification systems emphasizes that categories and standards can become infrastructural: once embedded in forms, databases, routines, software, reporting requirements, and professional practices, they organize how cases enter institutional processes (Bowker and Star 1999). The economic significance of a category therefore depends partly on the decisions and relations attached to it.

Administrative representation can also generate feedback. A category used to determine eligibility can induce subjects to reorganize documentation, timing, organizational form, or behavior around the classification. A compliance indicator can alter monitoring priorities. A standardized identity or registration status can create new channels of access while closing others. Such effects are empirical and institution-specific; the existence of an administrative category alone does not establish strong performativity.

12.24.3 Accounting Representation

Accounting representation organizes selected economic events and positions into records such as assets, liabilities, revenues, expenses, capital accounts, inventories, receivables, provisions, and cash flows. These records create a durable representational layer through which organizations remember transactions, compare periods, coordinate responsibilities, report to external parties, and make decisions about resources and obligations.

Accounting representation requires boundaries and valuation rules. A record depends on which entity is being represented, which event belongs to the reporting period, which asset or liability is recognized, how uncertain claims are treated, and which valuation convention is applied. These choices need not be arbitrary, but they are institutional and methodological decisions rather than transparent copies of an independently partitioned economic world. Standardized accounting can therefore increase comparability while also stabilizing particular ways of seeing organizational resources and obligations.

At macroeconomic scale, systems of national accounts provide a particularly clear example of institutionalized representation: economic activities are organized into

standardized institutional units, sectors, transactions, stocks, and flows so that otherwise heterogeneous processes can be compared and aggregated (European Commission et al. 2009). The resulting representations can be indispensable for analysis while remaining dependent on definitions, boundaries, imputations, and aggregation rules.

Proposition 12.132 (Accounting representation and organizational action). *Where accounting categories are linked to budgets, covenants, performance evaluation, taxation, reporting duties, or managerial authority, changes in accounting representation can alter feasible organizational action even when the underlying material configuration has not changed to the same degree.*

12.24.4 Statistical Representation

Statistical representation constructs populations, variables, distributions, indices, aggregates, classifications, and comparable series from selected observations. In economic systems, statistical representations can support diagnosis, comparison, forecasting, resource allocation, policy evaluation, and public communication. Their usefulness often depends on standardization across cases and time.

Statistical comparability is historically and institutionally produced. Categories such as employment, industry, household, sector, output, poverty, productivity, or price level require operational definitions and procedures for classification, sampling, aggregation, and revision. Desrosières' history of statistical reasoning shows how statistical conventions combine technical practices with institutional settlements about equivalence and comparability (Desrosières 1998). Quantitative objectivity can support impersonal coordination, yet standardized measures can also suppress distinctions that matter for particular questions (Porter 1995).

For GRE, statistical representation therefore has two simultaneous roles. It can reveal patterns that are difficult to perceive at the level of individual cases, and it can compress heterogeneous histories into a common representational space. Neither role is sufficient by itself to establish whether the representation is appropriate for a given decision. Aggregation, measurement error, category drift, missingness, selection, and changes in the data-generating process remain relevant to interpretation.

Remark 12.133 (Aggregation and relational heterogeneity). An aggregate can remain empirically useful while concealing differences in access, dependency, exposure, authority, or historical position among the units included in it. Disaggregation is therefore a problem-relative methodological choice rather than an automatic correction.

12.24.5 Contractual Representation

Contractual representation gives selected commitments, contingencies, permissions, duties, claims, remedies, and procedures a durable symbolic form. Contracts can coordinate expectations across time by specifying what participants may do, are expected to do, or can claim under stated conditions. They can also allocate risks, define transfer conditions, structure monitoring, and establish procedures for amendment, termination, or dispute.

The contract is both a representation of an intended relation and, where insti-

tutionally recognized, part of the relation itself. Institutional economics has long treated transactions and working rules as central to the organization of economic action (Commons 1931). A written contract can therefore affect bargaining, finance, authority, and future options even before the represented contingency occurs.

Contractual completeness remains limited by uncertainty, interpretation, enforcement costs, changing circumstances, tacit expectations, and the practical impossibility of specifying every relevant future state. Enacted relations can consequently diverge from written terms without making the contract economically irrelevant. GRE treats the contractual document, the legal-institutional framework, and the evolving practical relation as analytically distinguishable layers whose interaction must be reconstructed for the problem under study.

12.24.6 Price Representation

Prices symbolically represent exchange relations through quantities denominated in a unit of account. They can compress dispersed information about offers, expectations, scarcity conditions, costs, preferences, inventories, financing, strategic behavior, and institutional constraints into a form that participants can use for comparison and coordination. Hayek's account of dispersed knowledge remains an influential articulation of the coordinating role that price changes can play where relevant knowledge is distributed across many actors (Hayek 1945).

A price is nevertheless a selective representation. Similar observed prices can arise from different market structures, bargaining relations, information conditions, subsidies, taxes, market power, contractual terms, or expectations. Conversely, economically similar relations can be represented by different prices because of location, timing, risk allocation, quality, access conditions, or institutional differences. Price representation therefore should not be treated as a unique inverse map to the underlying relational configuration.

Prices can also become reference points for later action. Quoted prices can affect expectations, collateral valuation, contractual triggers, accounting marks, portfolio constraints, negotiations, or public perceptions. This possibility connects price representation to performativity without implying that every price movement is performative in a strong sense.

Proposition 12.134 (Price–configuration non-invertibility). *Observed price relations generally underdetermine the wider relational configuration that generated them. Inference from price to economic structure therefore requires additional evidence about institutions, participation, information, timing, bargaining, and other relevant mechanisms.*

12.24.7 Credit Representation

Credit relations depend heavily on symbolic representations of future obligation and anticipated capacity. Promissory claims, balances, repayment histories, collateral records, ratings, scores, limits, covenants, and risk classifications can mediate access to present resources in exchange for future obligations. Credit representation therefore connects current positions to expectations about later histories.

These representations are necessarily selective. A credit score or rating compresses a heterogeneous history into a tractable classification or numerical signal. A balance records contractual obligations but may not capture informal support, future institutional change, or the relational consequences of default. A collateral valuation represents one dimension of recoverability while depending on market conditions, legal enforceability, timing, and transaction costs.

Credit representation can become self-reinforcing where access to finance affects the later capacity that the representation was intended to assess. A classification that raises borrowing costs can reduce liquidity and investment capacity; an improved rating can expand access and alter future options. Such feedback does not establish that the original representation was false or arbitrary. It does mean that assessment and subsequent economic evolution may become coupled.

12.24.8 Digital Economic Representation

Digital economic representation encodes economic positions and relations in machine-readable forms such as identifiers, account states, transaction logs, scores, tokens, credentials, rankings, digital contracts, access permissions, recommendation states, and platform records. Digital encoding can make representations rapidly searchable, replicable, transferable, combinable, and executable across organizational processes.

The economic consequences depend on how the representation is embedded. A digital credential can mediate institutional access; a platform score can influence visibility or matching; a transaction log can support settlement or audit; a token can represent a claim, permission, or transfer state; and an automated classification can trigger differentiated treatment. Computational systems can therefore connect representation directly to action at speeds and scales that differ from many paper-based processes.

Digital representation can also concentrate control over categories, interfaces, data provenance, update rules, and error correction. Accountability may therefore require technical and institutional mechanisms capable of examining consequential computational procedures rather than relying only on ordinary review of individual human decisions (Kroll et al. 2017). GRE does not infer opacity or domination from digital mediation alone; the relevant questions concern control, contestability, alternatives, provenance, and the consequences attached to the encoded state.

Remark 12.135 (Digital representation and functional dependence). A digital representation becomes economically infrastructural when recurrent activities depend on its continued recognition, interoperability, or update rules. The degree of dependence remains an empirical property of the surrounding configuration rather than a property of digitality itself.

12.24.9 Representational Error and Mismatch

Economic representations can diverge from the relations they are intended to track. Error can arise through inaccurate observation, outdated data, coding mistakes, model misspecification, category mismatch, aggregation, strategic reporting, in-

complete records, measurement noise, or changes in the represented system. A representation can also be internally accurate according to its own rules while remaining poorly matched to the practical question for which it is later used.

GRE therefore distinguishes several forms of mismatch. *Observational mismatch* concerns inaccurate or incomplete recording. *Categorical mismatch* concerns a classification that groups together cases whose relevant mechanisms differ. *Temporal mismatch* arises when the representation describes an earlier configuration that has materially changed. *Scale mismatch* arises when a representation valid at one level is transported to another without adequate justification. *Functional mismatch* concerns the use of a representation for a task different from the one for which its construction and validation are appropriate.

The possibility of mismatch does not imply that symbolic representation should be avoided. Economic coordination at large scale often depends on compression, abstraction, and standardization. The methodological requirement is proportionate: the consequentiality of the decision, the possibility of correction, and the uncertainty of the representation can affect how much validation, provenance, disaggregation, or contestability is appropriate.

Remark 12.136 (Representation error and practical consequence). The practical significance of a representational error depends on the action architecture attached to it. The same measurement error can be negligible in exploratory analysis and consequential when it automatically determines eligibility, financing, sanctions, or irreversible commitment.

12.24.10 Revisability of Economic Representations

Economic representations operate in changing fields. Legal categories are amended, administrative records corrected, accounting treatments revised, statistical series re-based, contracts renegotiated, prices updated, credit assessments changed, and digital states recomputed. Revisability is therefore a structural property of many representational systems rather than evidence that representation has failed.

A useful revision architecture distinguishes correction from reclassification and from transformation of the represented relation. Correction changes the representation because the earlier record was inaccurate. Reclassification changes the representational scheme or category. Relational transformation changes the underlying economic position itself. These processes can occur together but should not be conflated because they imply different historical interpretations.

Revision also creates continuity problems. A revised statistical classification can reduce comparability with earlier periods; a corrected administrative status can leave residual consequences from actions taken under the earlier status; a changed credit assessment may not undo financing constraints already experienced; and a revised digital record can remain copied across other systems. Historical analysis should therefore retain provenance where earlier representations materially affected action.

Proposition 12.137 (Revision with representational provenance). *Where an economic representation has already influenced consequential action, later revision should*

analytically preserve the earlier representational state and its practical consequences when those consequences remain relevant to the history under study.

12.24.11 Performative Economic Representation

Some economic representations do more than record or summarize a field. They can enter the field through decisions, expectations, incentives, classifications, contracts, models, or institutional responses and thereby contribute to changing later relations. MacKenzie's analysis of financial models provides a well-known case in which representations can become incorporated into market practice rather than functioning only as external descriptions (MacKenzie 2006). Research on rankings similarly demonstrates how public measures can generate reactivity through organizational responses and self-reinforcing behavior (Espeland and Sauder 2007).

GRE uses *performative representation* in a conditional sense. Performativity requires an identifiable coupling between the representation and subsequent economic action. A forecast may influence investment; a rating may alter financing access; a classification may change eligibility; an index may become a contractual benchmark; an accounting threshold may trigger organizational action. The representation then participates in the history that produces later observations.

This coupling can strengthen, weaken, or transform the apparent validity of the representation. A prediction can contribute to its own realization, contribute to its own invalidation, or change the system in ways that make the original model less transportable. The analysis therefore requires attention to uptake, authority, institutional embedding, alternatives, and the population or process affected by the representation.

Proposition 12.138 (Conditional performativity of economic representation). *An economic representation is performative to the extent that its production, communication, recognition, or institutional uptake contributes through identifiable mechanisms to changes in the economic relations or histories subsequently observed. Representational salience alone does not establish performativity.*

12.24.12 Epistemic Events in Economic Fields

An epistemic event provides a broader frame for representations whose practical uptake changes economic evolution. It can include observation, classification, recognition, model output, communication, interpretation, or institutional acknowledgment that changes what relevant subjects know, expect, can contest, or are authorized to do. Symbolized economic relations provide recurrent channels through which such events enter economic fields.

The same representation can function as a readout or as a field-changing event. A statistical release can remain observational or alter expectations and policy; a credit assessment can remain diagnostic or become a gatekeeping event; a legal judgment can interpret an existing relation while changing recognized future positions. The distinction therefore depends on uptake, authority, and consequential action rather than on representational form alone.

Economic representations can also participate in recursive observation–action pro-

cesses: representations shape action, action changes relations, and later representations arise from the changed field. Historical reconstruction can distinguish the represented state from the representational event and its uptake where evidence permits.

Where a symbolic representation changes expectations, permissions, access, commitments, or decisions, the representational event can therefore be treated as part of the economic history rather than only as an external observation.

12.25 Economic Topology and Fields

Economic architecture can be described through named relations and institutions as well as through patterned connection, reachability, positional advantage, interruption, and position-dependent conditions of action. This section develops *economic topology* and *economic field* as optional analytical languages for those features. The objective is to identify when connectivity, centrality, clustering, bridging, bottlenecks, peripheral position, and field-like gradients add explanatory content beyond simpler descriptions of actors and bilateral relations. The discussion proceeds from network-structural properties to resource, capability, knowledge, and trust fields, and concludes with transformation of the represented topology or field. The method is relational and representational: graph, network, geometric, and field language is used only where the relevant economic mechanism is specified, with ontological suspension maintained throughout. Established network analysis provides mature tools for studying relational position and connectivity, while also demonstrating that measures such as centrality and clustering depend on the representation chosen and the substantive process being modeled (Wasserman and Faust 1994; Newman 2003; Freeman 1978; Fortunato 2010).

Definition 12.139 (Economic topology). Within this chapter, an *economic topology* is a representation of economically consequential patterns of connection, separation, reachability, adjacency, pathway, and position within a specified relational configuration. The term is used in an analytical sense unless a formal mathematical topology is explicitly defined.

Definition 12.140 (Economic field). An *economic field* is a representation in which economically relevant conditions, opportunities, constraints, expectations, resources, or capacities vary with relational position. Field language is warranted only when the position-dependent variation and the mechanism through which it matters can be specified.

These definitions separate topology and field from ontology. An economic system does not become literally a graph, metric space, or physical field merely because one of those representations is useful. The same empirical configuration can also be represented through institutions, histories, event complexes, contracts, organizational routines, or other formalisms. Representation choice should therefore be guided by the explanatory question and available evidence, with formal elegance remaining secondary to analytical fit.

Table 12.27 summarizes the principal analytical objects developed in this section. The dimensions overlap: a bridge can also be central, a bottleneck can arise through institutional as well as graph-structural mechanisms, and a peripheral position can

Table 12.27: Illustrative dimensions of economic topology and field analysis.

Dimension	Analytical question	Possible economic significance	Scope caution
Connectivity	which economically relevant positions are linked or reachable	access, propagation, coordination, redundancy	connection type, direction, weight, and timing matter
Centrality	which positions occupy structurally consequential locations	brokerage, visibility, reach, exposure, coordination	centrality interpretation should match the mechanism
Clustering	where dense local relational structure is concentrated	trust, coordination, redundancy, local closure	dense structure can also restrict alternatives
Bridging	which positions connect otherwise weakly connected regions	brokerage, translation, access to heterogeneous resources	bridge status depends on the selected boundary and relation type
Bottlenecks	where flows or actions depend disproportionately on limited passages	vulnerability, delay, gatekeeping, capacity constraint	apparent bottleneck may disappear under another pathway or scale
Periphery	which positions have limited connection to selected cores or pathways	reduced access, autonomy, specialization, exposure differences	peripheral status is relation- and scale-specific
Resource field	how resource availability varies by relational position	differentiated opportunity and conversion capacity	nominal resource presence may differ from effective access
Capability field	how feasible action varies across positions	heterogeneous action sets and adaptive capacity	capability cannot be inferred from resource location alone
Knowledge/trust field	how epistemic access and relational confidence vary spatially or structurally	learning, coordination, verification, cooperation	knowledge and trust remain mechanism-specific and revisable

retain substantial capability through resources unavailable to more centrally connected positions.

12.25.1 Network Connectivity

Connectivity concerns whether economically consequential positions are linked through pathways that permit some form of transfer, influence, access, coordination, observation, or obligation. A connection can involve exchange, communication, legal relation, ownership, credit, infrastructure, authority, trust, or another relation defined elsewhere in the chapter. Network representations are useful because they make pathway structure explicit, yet the presence of an edge remains an analytical construction whose meaning depends on the relation being represented (Wasserman and Faust 1994; Newman 2003).

Economic connectivity therefore has several dimensions. *Direct connectivity* con-

cerns an immediate relation between positions. *Indirect connectivity* concerns reach through sequences of relations. *Redundant connectivity* concerns the availability of alternative paths. *Temporal connectivity* concerns whether a pathway exists at the relevant time and in the relevant sequence. *Multilayer connectivity* concerns reach across different relation types, such as finance, information, logistics, ownership, and legal recognition, whose interaction may matter for the economic process (Kivelä et al. 2014; Holme and Saramäki 2012).

Connectivity alone does not establish effective access. A path can exist while being too costly, slow, capacity-constrained, legally unavailable, institutionally unrecognized, or practically unusable. Conversely, an actor with relatively few ties can retain substantial capability where those ties connect to highly substitutable resources or institutions. The economic interpretation of connectivity therefore requires relation-specific weights, direction, capacity, timing, and access conditions where these features materially affect the problem.

Proposition 12.141 (Connectivity–access non-equivalence). *Relational connectivity does not by itself establish effective economic access. Access depends additionally on the usability, capacity, timing, recognition, and conditions attached to the relevant pathway.*

12.25.2 Relational Centrality

Centrality describes structural prominence relative to a specified network representation. Established network analysis distinguishes several non-equivalent centrality concepts, including degree-like, closeness-like, and betweenness-like measures (Freeman 1978). Weighted-network extensions further show that tie number and tie strength can produce different positional interpretations (Opsahl et al. 2010). GRE therefore treats “central” as incomplete unless the relevant measure and economic mechanism are identified.

A position can be central because it maintains many direct relations, lies on numerous pathways, reaches others through relatively short paths, controls scarce interfaces, or occupies a highly connected layer of a multilayer system. These forms can correspond to different economic capacities. High degree may support information access or transaction opportunities; high betweenness may support brokerage or gatekeeping; proximity to relevant resources may matter even where a position is not globally central.

Centrality can also generate exposure. A highly connected intermediary may face correlated obligations, operational overload, systemic propagation, or dependence on maintaining many relationships. A central platform may coordinate large volumes of activity while becoming a concentrated point of failure. The economic significance of centrality therefore depends on the process being studied and should not be treated as a general scalar ranking of subjects.

Remark 12.142 (Mechanism-specific centrality). A centrality statistic earns economic interpretation only when the pathway represented by the statistic corresponds to a mechanism relevant to the inquiry. Structural prominence in one relation layer need not imply prominence in another.

12.25.3 Relational Clustering

Clustering concerns concentrations of comparatively dense relational connection. Network science provides several approaches to clustering and community structure, while the diversity of methods itself illustrates that clusters depend on modeling choices and need not correspond to naturally given social or economic groups (Newman 2003; Fortunato 2010). In GRE, clustering is therefore treated as a candidate representation of locally concentrated relational structure whose correspondence to a bounded economic community requires separate justification.

Dense local structure can support repeated interaction, reputation, mutual monitoring, coordination, shared conventions, or rapid information circulation. It can also produce redundancy, localized dependence, restricted search, exclusion of outsiders, or vulnerability to shocks shared within the cluster. The relevant consequence depends on relation type, internal heterogeneity, external links, and the broader institutional setting.

Clustering also interacts with the boundaries developed earlier in the chapter. A detected relational cluster may cross legal or organizational boundaries; a formally unified organization may contain several weakly connected clusters; and the cluster most relevant to information may differ from the cluster relevant to finance or authority. Cluster attribution should therefore remain relation- and purpose-specific.

12.25.4 Bridging Positions

A bridging position connects relational regions that would otherwise be more weakly connected under the selected representation. Bridges can be persons, organizations, institutions, infrastructures, standards, intermediaries, legal arrangements, or shared practices. Their economic significance can arise through brokerage, translation, certification, coordination, transfer, or access to heterogeneous resources.

A bridge need not possess formal authority. An accounting standard can bridge organizational domains by making records comparable; a payment infrastructure can bridge otherwise separate markets; a bilingual professional community can bridge knowledge domains; and an intermediary can connect suppliers with buyers while owning neither side of the transaction. Economic bridging is therefore a relational function whose carriers can vary across settings.

Bridging can expand collective capacity while producing dependence on the bridge. Where alternatives are scarce, the same bridging relation can become a bottleneck or gatekeeping position. Where alternatives are plentiful, bridge failure may be absorbed through substitution. The analysis should therefore examine redundancy, switching conditions, legitimacy, capacity, and the consequences of bridge removal when interpreting positional importance.

Proposition 12.143 (Conditional bridge significance). *The economic significance of a bridging position depends on the mechanisms it enables and on the availability, cost, and timing of alternative pathways. Bridging status alone does not establish indispensability.*

12.25.5 Relational Bottlenecks

A relational bottleneck occurs where the capacity of an economically relevant process is constrained disproportionately by a limited passage, interface, decision point, resource, or coordinating position. Bottlenecks can be material, infrastructural, informational, legal, administrative, organizational, or epistemic. They can therefore appear in a network representation without being reducible to graph structure.

The same configuration may contain different bottlenecks for different processes. A supply network can have ample physical transport capacity while facing certification delays; a financing system can possess liquidity while lacking underwriting capacity; an organization can possess information while concentrating decision rights in a slow approval channel. Identifying a bottleneck therefore requires specifying the relevant flow or action process and the constraint that limits it.

Bottlenecks can also be endogenous. Growth in one capacity may shift pressure to another part of the architecture. Increased demand can transform a previously adequate interface into a limiting passage; automation of one task can reveal a complementary human or institutional constraint; diversification can reduce one bottleneck while creating coordination burdens elsewhere. Bottleneck analysis is consequently historical and revisable.

Remark 12.144 (Bottleneck attribution). A bottleneck is attributed relative to a process, scale, horizon, and set of feasible alternatives. The designation should be revised when those conditions change.

12.25.6 Peripheral Positions

Peripheral position refers to comparatively limited connection, reach, recognition, or proximity relative to a selected core, pathway, or relational configuration. Economic peripherality can concern markets, institutions, infrastructure, information, finance, authority, or knowledge. It is therefore multidimensional and cannot be inferred reliably from geographic distance alone.

Peripheral positions can face reduced access to information, finance, infrastructure, decision processes, or exchange opportunities. They can also retain forms of autonomy, specialization, local knowledge, lower exposure to some shocks, or access to resources unavailable to more central positions. The economic consequences of peripherality are thus configuration-specific.

Core and periphery can also be relationally co-produced. Concentration of standards, finance, logistics, information, or authority in one region of a system can increase the relative distance of other positions even when their own local characteristics remain unchanged. Conversely, new infrastructure, interoperability, institutional recognition, or knowledge links can alter peripherality without physically relocating the affected subjects.

Caution 12.145 (Peripherality and normative inference). Peripheral position is a structural description relative to a specified configuration. Its normative significance depends on the associated capacities, exposures, dependencies, values, and available alternatives.

12.25.7 Resource Fields

Field language becomes useful where resource conditions vary systematically with relational position. A *resource field* represents how the practical availability, cost, reliability, or convertibility of resources differs across positions in a specified economic configuration. The relevant position can be geographical, institutional, organizational, network-based, legal, or otherwise relational.

Resource fields are more informative than simple resource maps when the position-dependent condition itself affects action. Credit can be nominally available across a jurisdiction while financing terms vary with institutional recognition, collateral relations, information, or network position. Infrastructure can be physically present while service reliability differs across users. Knowledge, time, and administrative support can also be unevenly distributed through organizational or institutional structure.

A resource field should therefore specify at least the resource type, the positional coordinate or relational index being used, and the mechanism through which position affects effective resource conditions. Where these cannot be identified, ordinary distributional description may be clearer than field language.

Remark 12.146 (Resource-field restraint). A resource field is a representation of position-dependent resource conditions. It does not imply that the resource behaves as a physical field or that a continuous spatial formalism is required.

12.25.8 Capability Fields

A *capability field* represents variation in feasible action across relational positions. It builds on the distinction developed earlier between resources and capacities: two positions with similar nominal resources can possess different feasible action sets because access, institutional recognition, complementary resources, knowledge, timing, coordination, or social relations differ.

Capability fields can therefore reveal conversion structure that a resource distribution alone misses. The same educational credential can enable different occupational options across jurisdictions; the same financial asset can support different borrowing capacity depending on legal and institutional relations; the same information can have different practical value depending on authority, timing, and complementary expertise.

Capability-field analysis can be static for a limited question, but GRE generally treats capability as historically revisable. Learning, institutional change, infrastructure, relationship formation, or accumulated obligations can alter the field over time. Actions taken within the field can also reshape later capabilities, producing feedback between position, action, and future feasible sets.

Proposition 12.147 (Resource-field-capability-field non-equivalence). *Similarity in represented resource conditions does not imply similarity in represented capability conditions. The conversion of resources into feasible action depends on additional relational, institutional, epistemic, and temporal conditions.*

12.25.9 Knowledge and Trust Fields

Knowledge and trust can also vary systematically with relational position. A *knowledge field* represents position-dependent access to relevant information, expertise, interpretation, or learning opportunities. A *trust field* represents position-dependent expectations concerning reliability, cooperation, credibility, or acceptable vulnerability within specified relations. These representations can help explain why formally similar actors face different coordination conditions.

Knowledge fields are shaped by information channels, organizational membership, professional communities, infrastructures, language, institutional classification, secrecy, and histories of participation. Trust fields can reflect repeated interaction, reputation, common institutions, recognized credentials, shared practices, and histories of fulfilled or violated commitments. Embeddedness research provides established reasons to analyze economic action within ongoing relational structures (Granovetter 1985; Powell 1990).

Knowledge and trust remain analytically distinct. Access to accurate information does not guarantee trust; trust can persist where information is incomplete; and high trust can sometimes reduce scrutiny or amplify correlated error. Field representations should therefore specify the underlying relation and avoid treating either knowledge or trust as a homogeneous scalar substance.

Caution 12.148 (Knowledge and trust field interpretation). Field language should preserve the mechanisms through which knowledge or trust varies across positions. A visually smooth field representation can conceal discontinuities, contested interpretations, heterogeneous trust relations, and institutional boundaries.

12.25.10 Field Transformation

Economic topologies and fields can change through relation formation and dissolution, institutional reform, infrastructure, technological change, migration, organizational reconfiguration, learning, shocks, regulation, platform redesign, or shifts in standards and classification. Transformation may alter positions, pathways, distances, clusters, bridges, bottlenecks, and the distribution of effective resources or capabilities.

Some transformations are endogenous to the represented field. New connectivity can change incentives to form further ties; central positions can accumulate additional relations; congestion can redirect flows; institutional recognition can relocate access; and repeated action can change trust or knowledge distributions. Adaptive-network research provides one formal example of this general possibility by studying systems in which network structure and node dynamics coevolve (Gross and Blasius 2008). GRE uses the broader insight without assuming that every economic topology should be represented through an adaptive-network model.

Transformation also changes the validity of prior representations. A centrality estimate, identified bottleneck, cluster boundary, or field gradient can become obsolete when the relational configuration changes. Topological and field analysis therefore requires temporal provenance where earlier representations have influenced consequential decisions.

Proposition 12.149 (Configuration-dependent topological description). *A topological or field description of an economic configuration is valid only relative to the represented relations, boundaries, scale, time, and mechanism. Material change in those conditions can warrant revision of both the empirical representation and the economic interpretation attached to it.*

Remark 12.150 (Representational plurality). Topology and field language constitute one family of representations within GRE. Where a simpler institutional, historical, qualitative, accounting, contractual, or event-based description better answers the economic question, the more elaborate spatial or network representation should not be preferred merely for formal sophistication.

12.26 Multiscale and Historical Architecture

Economic architecture is simultaneously organized across several scales and carried through historical time. This section develops a multiscale and historical description of economic systems that complements the relational, institutional, topological, and field representations developed elsewhere in the chapter. Its objective is to clarify how configurations formed at one scale can condition processes at another, how economic structures acquire and reproduce relative stability, and how crisis, reorganization, dissolution, path dependence, and emergence can alter the architecture through which later economic action becomes possible. The argument is analytical and historical rather than teleological: scales are selected relative to the process under study, historical continuity is treated as an empirical question, and no universal sequence of development is assumed.

The present framework also avoids treating “micro,” “meso,” and “macro” as fixed ontological layers. Individuals, households, organizations, institutions, markets, infrastructures, jurisdictions, transnational networks, and other configurations can become analytically relevant at different resolutions. Their relations can be nested, overlapping, or cross-cutting, and processes that appear aggregate at one scale can depend on heterogeneous lower-scale relations that aggregation conceals. Multiscale analysis is therefore justified where changing analytical resolution reveals mechanisms, constraints, capacities, or feedback that a single-scale description would miss. Explicit multiscale approaches in complexity research offer one family of representations for such questions, while GRE retains freedom to use historical, institutional, qualitative, network, or formal methods according to the problem (Bar-Yam 2004).

Definition 12.151 (Multiscale economic architecture). *A multiscale economic architecture is a historically situated configuration in which economically consequential relations, entities, institutions, capacities, constraints, and processes are represented at more than one analytically relevant scale, together with the mechanisms through which conditions at those scales interact.*

Table 12.28 summarizes the principal dimensions developed in this section. The entries are analytical prompts rather than an exhaustive taxonomy or a mandatory sequence of economic change.

Table 12.28: Selected dimensions of multiscale and historical economic architecture

Dimension	Analytical object	Scope discipline
Scale plurality	Relations and processes represented at different resolutions	Scales are problem-relative rather than fixed ontological levels
Cross-scale coupling	Mechanisms by which changes at one scale condition another	Aggregation, mediation, timing, and feedback require explicit specification
Formation	Assembly of relations, rules, capacities, and boundaries	Formation need not imply deliberate design or a single origin
Stabilization	Conditions sustaining relative continuity	Stability is dimension- and horizon-relative
Reproduction	Recurrent enactment of architecture through time	Reproduction can include variation, learning, and reinterpretation
Crisis	Disruption of established coordination, expectations, or viability	Crisis labels require identified mechanisms and relevant baselines
Reorganization	Recomposition of relations, roles, institutions, or scales	Reorganization can preserve some continuities while transforming others
Dissolution	Loss of sufficient coherence for a selected entity or configuration	Residual relations and obligations may survive dissolution
Path dependence	Historical sequencing that conditions later feasible alternatives	Persistence should be traced to specified mechanisms
Emergence	Appearance of economically consequential forms not captured by prior categories	Novelty remains scale-, description-, and evidence-dependent

12.26.1 Plural Scales of Economic Architecture

Economic processes can be represented at scales ranging from individual actions and household relations to organizations, industries, infrastructures, institutional systems, national economies, transnational production networks, and global financial or informational arrangements. These scales are not simply larger containers surrounding smaller ones. Each scale can select different relations, boundaries, time horizons, and mechanisms as analytically salient.

A household-level analysis can reveal care obligations, intrahousehold allocation, or dependency that disappear in national aggregates. An organizational analysis can reveal authority, coordination, and knowledge pathways concealed by sector-level statistics. A transnational analysis can reveal supply, ownership, financing, regulatory, or infrastructural relations that jurisdiction-specific descriptions divide into separate units. Conversely, highly aggregated analysis can disclose system-wide constraints or coordination patterns that cannot be inferred from one local case alone.

The choice of scale therefore carries epistemic consequences. Aggregation can stabilize measurement and make broad comparison possible while compressing heterogeneity. Fine-grained analysis can retain local relational structure while making system-level pattern more difficult to identify. Neither resolution is intrinsically su-

terior. GRE treats scale selection as part of the representation problem and asks what causal, institutional, distributional, or historical content becomes visible or hidden at the selected resolution.

Remark 12.152 (Scale-relative representation). A subject, entity, relation, constraint, or capacity can change analytical status when the scale of representation changes. Scale change therefore warrants renewed examination of what has been aggregated, decomposed, or treated as exogenous.

12.26.2 Cross-Scale Coupling

Multiscale analysis becomes especially important where processes at different scales are coupled. Local decisions can accumulate into aggregate demand, organizational routines can shape sectoral standards, national regulation can alter household or firm-level feasible action, and transnational infrastructures can condition the effectiveness of domestic policy. Causation can operate in several directions and can involve mediation, delay, threshold effects, or feedback.

Cross-scale coupling should therefore be specified through mechanisms rather than inferred from simultaneous change. A macroeconomic shift may affect subjects through prices, employment, credit, taxation, public provision, expectations, or institutional responses. Local innovations may become systemically consequential only after standardization, diffusion, financing, regulatory recognition, or network expansion. Intermediate organizations and institutions frequently mediate such translation.

Temporal scale also matters. Transactions and expectations can change rapidly, while legal structures, productive capabilities, infrastructures, trust relations, and organizational routines may change more slowly. The relative pace of these processes can affect whether coordination remains viable. Fast-slow language can be useful where distinct characteristic timescales are empirically defensible, but GRE treats scale separation as a hypothesis rather than a default description. During substantial transitions, previously separable dynamics can become tightly coupled.

Proposition 12.153 (Cross-scale attribution). *An observed association between changes at different economic scales supports a cross-scale explanation only to the extent that the analysis identifies plausible transmission, mediation, aggregation, or feedback mechanisms connecting the represented processes.*

12.26.3 Economic Formation Processes

Economic architecture forms through the establishment and recombination of relations, boundaries, roles, routines, institutions, infrastructures, representations, and capacities. Formation can be deliberate, incremental, negotiated, conflictual, imitative, technologically mediated, or partly unintended. The relevant history often contains several sources rather than a single founding event.

Formation is therefore better analyzed as a process than as a date. A market can form through repeated exchange, standards, legal recognition, information systems, specialized intermediaries, and expectations of continued participation. An organization can form through role differentiation, authority, coordination, memory, and

resource commitments. A platform or infrastructure can acquire economic significance as downstream actors reorganize activity around its interfaces. Institutional formation can proceed through formal rule creation as well as repeated practice and shared expectations.

Historical inquiry matters because different formation paths can produce configurations with similar present manifestations but different dependencies, obligations, memories, and capacities for change. Economic-historical and institutional traditions offer several ways of analyzing such processes, including accounts of the historical construction of market society and the role of institutions in shaping long-run interaction (Polanyi 1944; North 1990).

Remark 12.154 (Plural origins). Economic formation need not possess a singular origin. Where several processes jointly contribute to a later configuration, assigning one event as “the” origin can conceal the relational and historical conditions that made the configuration possible.

12.26.4 Architectural Stabilization

An economic configuration becomes relatively stabilized when selected relations, expectations, roles, routines, boundaries, or capacities persist sufficiently to support recurrent action and recognizable continuity. Stabilization can arise through contracts, law, standards, infrastructure, habits, organizational memory, shared expectations, sunk investments, technical compatibility, repeated coordination, or mutually reinforcing dependencies.

Stabilization is dimension-relative. Prices can remain volatile while ownership relations remain stable; organizational membership can change while routines persist; formal law can remain unchanged while administrative interpretation shifts. An architecture can therefore be stable along some dimensions and unstable along others. The relevant dimension and horizon should be stated rather than inferred from the word “stability” alone.

Stabilization can also be endogenous. Repeated use can increase familiarity, complementary investment, network density, or institutional support, thereby making continued use easier. Such mechanisms can generate persistence without implying optimality or desirability. Institutional analysis and increasing-return accounts provide established examples of mechanisms through which earlier arrangements can shape later possibilities (North 1990; Arthur 1989).

Proposition 12.155 (Dimension-relative stabilization). *The stabilization of an economic architecture should be attributed to specified dimensions, mechanisms, and time horizons. Persistence in one dimension does not establish general stability of the configuration.*

12.26.5 Historical Reproduction

Economic architecture persists through recurrent enactment. Contracts are renewed or replaced, rules are interpreted, organizational routines are performed, infrastructure is maintained, classifications are applied, skills are reproduced, expectations are updated, and participants enter or leave. Reproduction therefore differs from pas-

sive persistence: continuity commonly depends on repeated activity and resource commitments.

Reproduction can include variation. Each enactment occurs under current conditions and can modify the architecture it reproduces. Administrative implementation can reinterpret a rule, routine performance can generate learning, market participation can change expectations, and intergenerational transmission can alter the meaning or usability of inherited resources. Evolutionary economics has long emphasized routines, search, selection, and changing firm behavior as mechanisms of economic continuity and change (Nelson and Winter 1982).

Reproduction is also distributed across scales. Household practices can reproduce labor capacities; organizations can reproduce occupational roles and technical routines; institutions can reproduce classifications and rights; infrastructures can reproduce pathways of access and dependence. The architecture that appears stable at a higher scale may therefore depend on extensive lower-scale work that aggregate description does not display.

Remark 12.156 (Reproduction with variation). Historical reproduction in GRE permits modification, reinterpretation, and selective retention. Continuity should therefore be distinguished from exact replication.

12.26.6 Crisis and Architectural Disruption

A crisis can be represented as a period in which established relations, expectations, coordination mechanisms, access conditions, or institutional capacities become insufficiently reliable for activities that previously depended on them. The term should be used with care because disruption can be localized, sectoral, organizational, institutional, financial, ecological, or system-wide, and the same event can have very different consequences across positions.

Crisis analysis should identify the affected architecture and the mechanism of disruption. Relevant mechanisms can include liquidity breakdown, infrastructure failure, loss of trust, coordination failure, legal discontinuity, supply interruption, rapid repricing, institutional overload, conflict, or coupled failures across several domains. Some crises involve abrupt shocks; others become visible only after slow accumulation of vulnerability.

The concept also requires a baseline. A configuration can be experienced as crisis by some subjects while remaining functional or even advantageous for others. Declaring a crisis therefore does not substitute for analysis of affected capacities, exposures, distributions, and time horizons. Where critical-transition models are invoked, their assumptions and empirical indicators require separate justification; crisis and criticality should not be treated as synonyms.

Caution 12.157 (Crisis attribution). The label *crisis* should identify the configuration, functions, capacities, or relations whose continuity has become materially disrupted. It should not be used as a general intensifier for economic change.

12.26.7 Economic Reorganization

Economic reorganization occurs when relations, roles, boundaries, institutions, technologies, infrastructures, ownership structures, or coordination mechanisms are re-composed in ways that alter how the architecture operates. Reorganization can follow crisis, but it can also arise through innovation, policy change, organizational learning, demographic change, new standards, shifting expectations, or gradual accumulation.

Reorganization can preserve substantial continuity. A firm can reorganize authority while retaining legal identity; a market can reorganize around new intermediaries while many participants remain; an institution can alter administrative procedures while formal legislation remains stable. Conversely, apparently modest changes in standards, classifications, or interfaces can reorganize access and dependency across an entire field.

The relevant analytical question is therefore what relational architecture changed and what remained continuous. Schumpeterian analysis of innovation and later evolutionary work on technological trajectories and institutional coevolution provide influential accounts of economic change in which new combinations and evolving technical-institutional structures reorganize production and competition (Schumpeter 1934; Dosi 1982; Nelson 1994).

Proposition 12.158 (Reorganization with selective continuity). *Economic reorganization can transform the operating structure of a configuration while preserving selected entities, relations, institutions, or historical obligations. The extent of reorganization is therefore dimension-specific.*

12.26.8 Architectural Dissolution

An economic architecture can lose sufficient coherence that it no longer functions as the configuration previously identified. Dissolution can occur through organizational closure, relation termination, institutional abandonment, technological obsolescence, fragmentation, loss of membership, infrastructure withdrawal, legal change, conflict, or gradual disappearance of the practices that sustained the architecture.

Dissolution should be distinguished from instantaneous disappearance. Assets, liabilities, knowledge, environmental effects, contractual claims, reputations, social obligations, data, standards, and infrastructures can survive the configuration that generated them. Participants can also carry learned routines, expectations, and dependencies into later arrangements. The historical consequences of a dissolved architecture can therefore continue to shape subsequent economic fields.

The threshold at which dissolution is attributed depends on the analytical object. A corporation can dissolve legally while an operational network persists; a market category can disappear while exchange relations continue under another classification; an institution can lose formal recognition while informal practices remain. Dissolution, like entityhood, is consequently a revisable attribution relative to specified dimensions.

Remark 12.159 (Residual architecture). The dissolution of an economic configuration

need not dissolve the relations, obligations, capacities, or material consequences produced during its history. Residual structure can become part of the conditions under which later architectures form.

12.26.9 Path-Dependent Architecture

Path dependence concerns cases in which the sequence of earlier events materially conditions later feasible alternatives, costs, expectations, or probabilities of continuation. The concept is useful when historical order contributes explanatory content beyond current-state variables alone. Economic applications have emphasized mechanisms including increasing returns, technical interrelatedness, learning, coordination effects, quasi-irreversibility, and institutional self-reinforcement (David 1985; Arthur 1989; Pierson 2000).

GRE treats path dependence as mechanism-specific. Historical persistence can arise from several processes, and not every durable configuration is path dependent in the same sense. A researcher should therefore identify what earlier event or sequence altered later possibilities and through which mechanism the effect persists. The analysis should also retain the possibility of branching, recombination, and later transformation.

Path dependence can operate across scales. Household wealth, organizational routines, technological standards, legal classifications, infrastructure placement, and transnational production arrangements can each create inherited conditions that affect later options. Cross-scale feedback can reinforce or weaken these effects. Early local choices can acquire wider significance through diffusion or standardization, while system-level change can reopen alternatives that appeared locally locked in.

Proposition 12.160 (Mechanism-specific path dependence). *A claim of economic path dependence should identify the historical sequence and the mechanism through which that sequence changes later feasible alternatives, costs, capacities, or transition conditions. Persistence alone is insufficient to establish path dependence.*

12.26.10 Emergence of New Economic Forms

Economic history can generate configurations for which inherited categories provide only partial description. New organizational forms, technologies, transaction architectures, property arrangements, infrastructures, labor configurations, financial instruments, communities, or combinations of these can create relations and capacities that were previously absent or analytically negligible. Complexity and evolutionary perspectives have offered several ways of studying novelty arising through heterogeneous adaptation, innovation, and interaction (Arthur 1999; Nelson and Winter 1982).

Emergence should nevertheless be claimed cautiously. A configuration can appear new because the observer changed scale, classification, or measurement rather than because the underlying economic relations changed substantially. Conversely, a familiar label can conceal a relationally novel architecture. Claims of novelty therefore require comparison of mechanisms, positions, capacities, boundaries, and histories rather than reliance on naming alone.

New forms can also reorganize the scales at which economic activity becomes intelligible. A platform can connect local exchange to transnational infrastructure; a new legal form can coordinate dispersed ownership; a technical standard can create a field spanning several industries; an institutional innovation can alter the relation between household, organization, and state. The emergence of form and the emergence of analytical scale can therefore be intertwined.

Remark 12.161 (Emergence and evaluation). The emergence of a new economic form establishes neither novelty's desirability nor its durability. New configurations can expand capacities and options while also generating dependencies, exclusions, fragilities, or constraints. Their normative and practical evaluation requires additional argument.

Multiscale and historical architecture thus provides a way to describe economic systems as temporally evolving configurations whose relevant scales, boundaries, and mechanisms can themselves change. The representation remains provisional: a scale that is adequate for one historical question can be misleading for another, and a model that captures stabilization can become inappropriate during substantial reorganization. GRE therefore treats scale and history as dimensions of the economic object rather than as background variables appended after a static architecture has already been defined.

12.27 Generative Potential of Economic Architecture

Economic architecture matters not only through its present distributions, organizations, institutions, relations, and constraints, but also through the range of later configurations that it makes more or less accessible. This section develops *generative potential* as a provisional analytical language for studying those future-shaping properties. Its objective is to distinguish the generation of relations, capabilities, knowledge, participation, options, constraints, and dependence; to examine self-reinforcing, differentiated, and fragile generative structures; and to clarify how economic architecture can alter transition possibilities and the relative accessibility of alternative histories. The method is relational, historical, and mechanism-oriented. Generative potential is treated as conditional on specified subjects, scales, histories, and horizons rather than as a universal scalar property of an economy.

The term *potential* requires particular restraint. It does not denote an outcome that will necessarily occur, and it need not denote an objective probability. It also differs from capacity. A capacity concerns what a subject or configuration can effectively do under specified conditions; generative potential concerns how an architecture conditions the formation of later relations, capacities, options, constraints, dependencies, and transition paths. A configuration can therefore contain substantial generative potential that remains unrealized, while a realized change can arise from a comparatively narrow potential when a particular event, intervention, or disturbance selects one path among many.

The adjective *generative* is likewise descriptive before it is normative. Economic architecture can generate cooperation, knowledge, productive capacity, participation, and new options. It can also generate exclusion, constraint, dependence, concentra-

Table 12.29: Selected dimensions of generative potential in economic architecture

Dimension	Analytical question	Scope discipline
Relation generation	Which new or transformed relations become feasible or recurrent?	Relation formation requires identified mechanisms and participants
Capability generation	Which effective abilities can later be formed or expanded?	Resources and nominal access do not by themselves establish capability
Knowledge generation	Which processes create, retain, interpret, or distribute usable knowledge?	Information production and knowledge formation remain distinct
Participation generation	Which forms of contribution, representation, access, or influence become possible?	Participation depth and distribution require separate analysis
Option generation	Which later courses of action become feasible, affordable, or institutionally available?	Option counts alone do not establish practical value
Constraint generation	Which later restrictions, obligations, bottlenecks, or exclusions are produced?	Constraints are position-, process-, and horizon-relative
Dependence generation	Which capacities become reliant on actors, resources, infrastructures, or permissions elsewhere?	Dependence is dimension-specific and need not imply domination
Self-reinforcement	Which feedbacks increase the persistence or reproduction of a configuration?	Persistence should be traced to mechanism rather than inferred from duration alone
Differentiated potential	How is future-generating capacity distributed across positions and scales?	Difference does not by itself establish normative ranking
Fragility	Which generative capacities depend on narrow supporting conditions or vulnerable complementarities?	Fragility is relative to disturbance, horizon, and recovery possibilities
Transition potential	Which configurations or histories become more or less accessible as the architecture changes?	History weights require explicit interpretation and need not be probabilities

tion, vulnerability, and reduced alternatives. The existence or magnitude of generative potential therefore establishes neither desirability nor justice. Those evaluations require additional normative and empirical argument.

Definition 12.162 (Generative potential of economic architecture). The *generative potential of an economic architecture* is the historically situated and relation-dependent capacity of that architecture to make specified future relations, capabilities, knowledge states, participation forms, options, constraints, dependencies, or transitions more or less accessible over a stated scale and horizon. The concept does not require a single metric, probability distribution, or normative ranking.

Table 12.29 summarizes the principal dimensions considered in this section. The list is illustrative rather than exhaustive. Additional forms of generative potential may become relevant as economic arrangements, technologies, institutions, and forms of agency change.

Proposition 12.163 (Potential–realization non-equivalence). *An economic architecture can make a future configuration comparatively accessible without that configuration being realized. Realization depends on subsequent events, choices, interventions, disturbances, interpretations, and interactions that are not exhausted by the architecture’s prior generative potential.*

12.27.1 Generation of Relations

Economic architecture can condition which relations become possible, recurrent, costly, prohibited, attractive, or institutionally recognizable. Property rules can enable some contractual relations while excluding others. Infrastructures can make recurrent exchange or coordination possible across distance. Organizational routines can create durable authority and knowledge relations. Standards can make previously disconnected systems interoperable. Platforms can establish recurrent mediation among actors who would otherwise interact only intermittently or through different intermediaries.

Relation generation does not require deliberate design. Repeated interaction can produce trust, dependence, conventions, reputational relations, or informal obligations that were not specified in advance. Conversely, deliberate institutional design can fail to generate the relation it was intended to create if complementary capacities, expectations, or enforcement conditions are absent. The relevant question is therefore not whether a formal opportunity for relation exists, but which mechanisms make relation formation practically accessible and reproducible.

New relations can also alter the architecture that generated them. A newly formed supplier relation can create specialized investment; specialized investment can deepen dependence; dependence can affect bargaining, information sharing, and later contracting. Relation generation is consequently recursive. The architecture conditions relation formation, and newly formed relations can become part of the architecture conditioning subsequent relations.

Remark 12.164 (Relational generation and persistence). A relation’s generation and its later persistence are distinct analytical questions. Conditions sufficient for initial formation may differ from those that reproduce, deepen, transform, or dissolve the relation over time.

12.27.2 Generation of Capabilities

Economic architectures can generate capabilities by combining resources, access, knowledge, coordination, institutions, infrastructures, and complementary relations in ways that make previously unavailable action feasible. A training system can convert time, instruction, institutional recognition, and practice into later professional capability. A transport or digital infrastructure can expand the practical reach of existing resources. An organization can combine differentiated expertise into capacities unavailable to any individual member. A public institution can make a legal entitlement operational through administrative procedures, information, and implementation capacity.

Capability generation should not be inferred directly from resource accumulation.

Section 12.17 established resource–capacity non-equivalence: effective capacity depends on conversion conditions and relational position. The same point extends dynamically. An architecture can possess resources yet have weak capability-generating potential when access, coordination, learning, or complementary conditions are missing. Conversely, modest resources can sometimes support substantial capability formation when institutional and relational complementarities are strong.

Capability-oriented economic analysis has long emphasized the distinction between resources and effective opportunities (Sen 1999). GRE extends that distinction historically by asking how architectures participate in the formation, maintenance, erosion, and redistribution of capabilities through time. The resulting potential can be collective as well as individual. Organizational routines, shared infrastructures, public institutions, communities of practice, and interoperable standards can generate capacities located partly in relations among participants rather than in any one actor.

Proposition 12.165 (Architecture-relative capability generation). *The capability-generating potential of an economic architecture depends on the mechanisms through which resources, access, knowledge, coordination, and complementary relations become usable together. Resource quantity alone is insufficient to determine that potential.*

12.27.3 Generation of Knowledge

Economic architecture can generate knowledge through observation, experimentation, production, exchange, repeated interaction, record keeping, comparison, classification, scientific inquiry, professional practice, and organizational learning. The knowledge produced can concern technologies, demand, costs, institutions, other participants, ecological conditions, risks, or the operation of the architecture itself.

Knowledge generation is distributed. Hayek’s analysis of dispersed knowledge remains relevant to the difficulty of aggregating context-specific information into one decision center (Hayek 1945). Organizations and institutions can nevertheless create mechanisms for retaining, interpreting, and transmitting knowledge across time. Routines, databases, standards, professional communities, records, models, and embodied expertise can each participate in that process. Evolutionary accounts of firms likewise emphasize routines, search, and learning as mechanisms through which economic behavior changes historically (Nelson and Winter 1982).

The architecture that generates knowledge can also shape what becomes knowable. Classification systems define categories of observation; accounting systems establish units of comparison; incentives affect what participants report; infrastructures determine what can be measured; authority structures influence which observations receive attention. Knowledge generation therefore includes epistemic selectivity. An architecture can improve knowledge in one dimension while making other dimensions less visible.

Generated knowledge can in turn alter economic relations. A forecast can change investment; a classification can change eligibility; an audit can alter organizational behavior; a technical discovery can reorganize production. Knowledge generation therefore interacts with the performative and epistemic-event architecture devel-

oped in Section 12.24. The relevant analysis should distinguish production of a representation from the later consequences produced through its uptake.

12.27.4 Generation of Participation

Economic architecture can generate participation by creating roles, memberships, access pathways, contribution opportunities, representational channels, and decision interfaces. Education can make occupational participation possible; infrastructure can enable participation at distance; institutional recognition can make a group eligible for programs or governance processes; organizational design can create new roles through which participants contribute knowledge or labor.

Participation generation is multidimensional. Entry into a market does not guarantee influence over its rules. Organizational membership does not ensure access to strategic decisions. Digital connectivity does not ensure visibility. Formal citizenship or legal status does not guarantee procedural usability of institutions. The relevant potential therefore concerns the kinds and depth of participation that become practically available to particular positions.

Participation can also reshape the subjects who participate. Repeated work can generate skill and professional identity; collective governance can generate procedural knowledge and trust; participation in credit, insurance, or platform systems can create records that affect later eligibility. These effects can expand later options while also producing new obligations, monitoring, dependency, or exposure. The generative potential of participation thus includes the production of future positions, not merely the immediate opportunity to take part.

Remark 12.166 (Participation as generated position). A participation opportunity can be economically consequential even when immediate material transfer is small, because participation may alter knowledge, recognition, reputation, obligations, network position, or later access. These consequences require empirical specification rather than automatic attribution.

12.27.5 Generation of Options

Economic architecture can alter the set of later actions that are practically available. Savings can create waiting capacity; interoperable standards can make switching feasible; education can open occupational alternatives; public infrastructure can expand geographic reach; legal forms can enable new modes of association; insurance can make otherwise prohibitive risks bearable. In this sense, some architecture is option-generating.

An option should be distinguished from a merely imaginable alternative. Practical options depend on resources, access, permissions, timing, information, capabilities, and complementary relations. They can also expire. A financing opportunity available before a deadline, a labor-market option dependent on a credential, or an exit route dependent on interoperability may disappear as conditions change. Option generation is therefore historical and time-sensitive.

A larger option set does not automatically imply a better practical condition. Options can impose cognitive burden, generate strategic uncertainty, or be irrelevant to

the subject's aims. Some forms of commitment deliberately close options in order to enable cooperation, investment, trust, or specialization. GRE therefore treats option generation as one analytical dimension among others, not as a universal objective.

The practical importance of options becomes especially visible under uncertainty. Architectures that preserve several feasible pathways can permit later adaptation as knowledge changes, while highly specialized architectures can concentrate capability around fewer paths. Whether such concentration is advantageous depends on expected benefits, reversibility, disturbance, coordination requirements, and the values at stake.

12.27.6 Generation of Constraints

Generative architecture can produce constraints as well as options. Investment can create sunk commitments. Standards can narrow compatible technologies. Organizational specialization can reduce substitutability. Legal arrangements can create obligations and restrictions. Infrastructures can orient activity around particular routes or interfaces. Classification systems can exclude positions that do not fit established categories. The production of constraint is therefore part of generative analysis rather than an exception to it.

Generated constraints can be enabling. A common standard can restrict design freedom while making interoperability possible. Contractual commitment can reduce unilateral discretion while enabling coordinated investment. Professional rules can restrict practice while supporting trust and shared expectations. The analytical task is to identify which capacities a constraint enables, which it restricts, for whom, and over what horizon.

Constraint generation can also be cumulative. A series of individually modest commitments can produce a configuration that becomes costly to alter. Technical compatibility, contractual obligations, organizational routines, reputational expectations, and infrastructure can reinforce one another. Historical analysis is needed to distinguish such cumulative constraint from an intrinsic impossibility.

Proposition 12.167 (Generative constraint formation). *An economic architecture can expand selected capacities while simultaneously generating constraints on other actions or later transitions. Generative analysis should therefore track capability formation and constraint formation together rather than treating them as opposing processes.*

12.27.7 Generation of Dependence

Architectures that expand capacity often do so through specialization and complementarity. These same processes can generate dependence. A firm can gain productive capacity by relying on a specialized supplier; a household can gain access through a platform while becoming dependent on its interface; an organization can benefit from expert knowledge while losing internal capability to evaluate it; a jurisdiction can gain efficiency through shared infrastructure while becoming exposed to disruptions elsewhere.

Dependence generation therefore should not be treated as evidence that the under-

lying architecture has failed. Mutual dependence can enable coordination and collective capacity. The analytical question concerns the dimensions, alternatives, substitutability, exit conditions, and distribution of the dependence. Dependence becomes especially consequential where access to a necessary complement is concentrated, difficult to replace, or governed by rules that participants cannot readily influence.

Generated dependence can also alter future bargaining and knowledge. Specialized investment can reduce exit options. Repeated delegation can erode internal expertise. Reliance on one classification or standard can make later migration costly. These processes can create feedback through which earlier capacity-enhancing choices change later relational positions.

Remark 12.168 (Capacity–dependence coupling). The same architectural relation can generate capacity and dependence simultaneously. Assessment therefore requires dimension-specific analysis of what is gained, what becomes reliant on external conditions, and which alternatives remain practically available.

12.27.8 Self-Reinforcing Generative Structures

Some generative processes alter the conditions of their own continuation. Learning can reduce later production costs; wider adoption can increase the usefulness of a standard; organizational routines can make repeated coordination easier; accumulated records can improve later prediction; reputation can attract additional partners; institutional familiarity can reduce transaction or compliance costs. Under such conditions, the realized history can increase the accessibility of related later histories.

Increasing-return and path-dependence literatures provide well-known formal and historical examples of self-reinforcement. Arthur shows how increasing returns can make early adoption events consequential for later technological selection, while Pierson emphasizes how increasing-return mechanisms can magnify timing and sequence in institutional development (Arthur 1989; Pierson 2000). GRE uses these mechanisms as examples rather than as a universal account of generativity.

Self-reinforcement should be distinguished from simple persistence. A configuration can persist because external conditions remain stable without becoming increasingly self-supporting. Conversely, a self-reinforcing process can eventually encounter countervailing constraints, saturation, institutional change, technical substitution, or political opposition. Claims of self-reinforcement therefore require identification of the feedback through which prior realization alters later continuation conditions.

Self-reinforcement can operate across different generative dimensions. Capability can generate knowledge; knowledge can improve coordination; coordination can attract participation; participation can expand a network; network expansion can improve access to resources. A reinforcing configuration can therefore involve several coupled processes rather than one homogeneous feedback loop.

Proposition 12.169 (Mechanism-specific self-reinforcement). *A claim that economic architecture is self-reinforcing should identify the mechanism through which earlier realization changes the conditions of later reproduction or expansion. Persistence, growth, or repeated observation alone does not establish self-reinforcement.*

12.27.9 Differentiated Generative Potential

Generative potential can be distributed unevenly across subjects, positions, organizations, places, and scales. The same infrastructure can expand options for one group while offering limited usability to another. A financial arrangement can provide one actor with investment capacity while placing another in a dependent creditor–debtor relation. A knowledge system can make some participants better able to classify, predict, or redesign the field than others. These differences concern the distribution of future-generating positions rather than only the distribution of current stocks.

Differentiated generative potential is not reducible to the economic asymmetries described in Section 12.23. A present resource or capability asymmetry can contribute to later generative difference, but generative potential also depends on conversion pathways, institutional recognition, topology, time horizons, option structure, and the capacity to alter rules or infrastructures. Two subjects with comparable present resources can therefore possess different capacities to shape future relations.

The concept also requires restraint. Greater generative potential in one dimension does not establish a general ranking of persons or organizations, and unequal generative potential does not by itself establish injustice. Normative analysis requires additional claims about rights, welfare, responsibility, legitimacy, distribution, and affected interests. The descriptive contribution is to identify where the architecture gives different positions different capacities to produce or redirect later economic possibilities.

Proposition 12.170 (Position-relative generative potential). *The generative potential of an economic architecture can differ across relational positions even when those positions participate in the same formal institution, market, organization, or infrastructure. Attribution should therefore identify the subject, dimension, horizon, and mechanism to which the potential refers.*

12.27.10 Generative Fragility

An architecture can possess substantial generative potential while depending on a narrow set of supporting conditions. This condition can be described as *generative fragility*: the production of valued or economically consequential capacities, relations, or options depends strongly on components, complementarities, expectations, or pathways that are vulnerable to disruption.

Fragility is relative to disturbance. A supply architecture can be robust to ordinary demand variation while fragile to the loss of one specialized input. A knowledge system can be robust to personnel turnover while fragile to the disappearance of a particular archive or interface. A platform can sustain many users while remaining dependent on a small number of infrastructural services. No architecture is simply fragile in the abstract; the analysis should identify the disturbance, affected generative function, recovery mechanism, and horizon.

Generative fragility can arise from concentration, tight coupling, low substitutability, temporal synchronization, hidden dependencies, insufficient redundancy, or reliance on tacit knowledge concentrated in few positions. It can also arise from successful specialization. An arrangement optimized around a narrow set of conditions may

generate exceptional capacity while those conditions hold and adapt poorly when they change.

The relation between fragility and evaluation remains context-dependent. Redundancy can preserve capacity under disturbance while imposing cost. Tight coordination can increase efficiency while reducing flexibility. Specialization can generate knowledge while narrowing alternatives. GRE therefore treats generative fragility as a property to be investigated rather than a universal reason to favor one architecture over another.

Definition 12.171 (Generative fragility). *Generative fragility* is the sensitivity of an architecture's specified capacity to generate relations, capabilities, knowledge, participation, options, or other economically consequential forms to disruption of the supporting conditions on which that generative process depends.

12.27.11 Transition Potentials and Historical Reweighting

Generative potential becomes especially significant when economic architecture is represented through alternative possible histories. Resources, institutions, topology, expectations, dependencies, constraints, and accumulated history can make some transitions comparatively accessible and others comparatively difficult. *Transition potential* denotes these architecture-relative conditions affecting which later configurations can plausibly be reached and through which paths.

Transition potential need not be a physical potential function or an objective probability. A formal model may assign probabilities, propensities, costs, feasibility scores, or other weights to alternative histories; qualitative analysis may reconstruct relative accessibility through institutional barriers, historical precedents, path dependence, actor capacities, or scenario comparison. The interpretation of a history weight should therefore be stated explicitly.

Events can reweight later possibilities. Law can enable previously unavailable organizational forms; technical change can alter path costs; crisis can unsettle established assumptions; epistemic events can change expectations or classifications; interventions can create new resources, dependencies, or constraints. Such changes may alter the relative accessibility of histories even when the set of imaginable futures remains similar.

Historical reweighting can also be asymmetric. An intervention can expand one actor's options while narrowing another's; a standard can facilitate one trajectory while increasing switching costs for alternatives; infrastructure can open one regional pathway while redirecting investment elsewhere. Cross-scale analysis is therefore relevant when local changes modify wider transition conditions or aggregate changes restructure local feasible histories.

Proposition 12.172 (Architecture-relative transition potential). *A claim that economic architecture favors, suppresses, or reweights a future history should identify the represented alternatives and the mechanisms changing their relative feasibility, cost, accessibility, propensity, or support. History weights need not be interpreted as objective probabilities unless the model warrants that interpretation.*

12.28 Allocation within Economic Architecture

Allocation is often represented as a problem of assigning scarce resources among recipients. Within the economic architecture developed in this chapter, that representation remains useful for some questions, but it captures only one layer of the practical object. An allocation can change holdings while also altering access, capacities, obligations, dependence, authority, organizational routines, institutional recognition, relational positions, and the range of later economic possibilities. This section develops a preliminary architectural account of allocation that preserves those additional dimensions without yet specifying a complete theory of allocation. Its objective is to identify the principal objects and relational consequences that an allocation analysis may need to track. The discussion proceeds through resources, intervention, administrative recipients, relation-indexed and higher-order allocation, multiscale effects, asymmetry, and a provisional relational allocation framework. The method is synthetic and architecture-oriented: it draws on the economic objects developed throughout this chapter while keeping the resulting framework open to later empirical, formal, and normative specification.

The term *allocation* is used here broadly for a rule, decision, process, or historically produced arrangement that changes who or what can access, use, control, receive, contribute, retain, or mobilize specified economic resources or enabling conditions. This definition includes direct assignment of material or financial resources, while also permitting allocation of time, information, infrastructure, institutional access, decision rights, attention, technical capacity, and other conditions whose economic significance depends on the surrounding architecture. It does not imply that these heterogeneous objects are commensurable in one metric.

Definition 12.173 (Allocation within economic architecture). *An allocation within economic architecture is a situated change in the distribution, accessibility, usability, control, or relational positioning of specified economic resources or enabling conditions, together with the consequential changes that the allocation can induce in relations, capacities, constraints, dependencies, institutions, and later feasible histories.*

Table 12.30 summarizes the main dimensions developed in this section. The table is an analytical repertoire rather than a mandatory checklist. Some allocation problems can be represented adequately at the level of recipients and holdings; others require relational, higher-order, multiscale, or historical analysis because those dimensions materially affect the consequences of allocation.

Proposition 12.174 (Recipient–consequence non-equivalence). *The formal recipient of an allocation need not coincide with the subject, relation, organization, institution, or scale at which its economically consequential effects are realized. Allocation analysis should therefore distinguish administrative receipt from effective incidence and relational consequence when those differences matter to the inquiry.*

12.28.1 Resources within Architecture

The economic significance of an allocated resource depends on the architecture into which it enters. A monetary transfer can expand practical capacity where complementary infrastructure, legal standing, knowledge, time, and institutional access are

Table 12.30: Selected dimensions of allocation within economic architecture

Dimension	Analytical question	Scope discipline
Allocated object	What resource, access condition, right, capability-enabling condition, or control position is being allocated?	Heterogeneous objects should not be aggregated without a justified conversion rule
Administrative recipient	Which person, household, organization, institution, or other unit formally receives the allocation?	Formal receipt may differ from effective access, use, control, and downstream incidence
Relational consequence	Which relations are formed, stabilized, transformed, weakened, or dissolved?	Relational effects require identifiable mechanisms rather than inference from transfer alone
Higher-order structure	Which collective, institutional, infrastructural, or field-level configuration is affected?	Group-level effects should not be inferred from individual receipt without aggregation or coordination mechanisms
Scale	At which local, organizational, institutional, regional, national, or transnational scales do effects arise?	Cross-scale claims require explicit transmission, mediation, or feedback mechanisms
Asymmetry	How do differences in capacity, access, information, dependence, or institutional position shape incidence?	Asymmetry is dimension-specific and does not by itself establish a normative conclusion
Temporal structure	Which effects are immediate, delayed, recurrent, cumulative, reversible, or path dependent?	Present allocation and later consequence should remain analytically distinct
Generative effect	Which later capacities, constraints, options, dependencies, or transition paths become more accessible?	Generative consequence is descriptive before normative evaluation

available. The same nominal transfer can have a different effect where those conditions are absent or where debt, gatekeeping, care responsibilities, geographic isolation, or other constraints absorb much of its practical usefulness. Resource quantity and allocative consequence are therefore analytically distinct.

Section 12.16 developed resourcehood as relation- and capacity-relative. That distinction becomes especially important in allocation analysis. Material, financial, temporal, spatial, informational, knowledge, attentional, infrastructural, institutional-access, and relational resources can enter different conversion pathways and can differ in durability, divisibility, transferability, and dependence on complementary conditions. A theory that records only the nominal amount assigned can therefore omit the mechanism through which the allocation becomes usable.

The architecture can also determine whether a resource remains available after allocation. A grant may be contingent on reporting requirements; access to infrastructure can depend on standards or membership; knowledge can require repeated interaction for effective transfer; time can be lost if administrative delay shifts the relevant opportunity window. Allocation is consequently embedded in rules of retention, conversion, recognition, and continued accessibility.

Remark 12.175 (Resource allocation and conversion conditions). Where conversion conditions materially affect the use of an allocated resource, analysis should record those conditions rather than infer capability directly from nominal allocation. The relevant conversion architecture can itself become an object of allocation or institutional change.

12.28.2 Allocation as Intervention

An allocation can be represented as an intervention in an existing relational configuration. The intervention changes some distribution of resources, access conditions, rights, obligations, permissions, or control positions, and the changed configuration can subsequently generate further consequences. The intervention may be deliberate, as in a budgetary decision, eligibility rule, infrastructure investment, or organizational assignment. It may also be produced by decentralized processes, inherited institutions, contractual arrangements, market exchange, or historically accumulated ownership structures.

Treating allocation as intervention does not require a centralized allocator. The analytical point concerns the change induced in the economic configuration. A market transaction allocates resources through exchange; a platform ranking can allocate visibility; an inheritance regime can allocate claims across generations; an organizational rule can allocate decision authority; a queue can allocate temporal priority; a technical standard can allocate compatibility and exclusion. These mechanisms differ institutionally, yet each can alter later capacities and relations.

The intervention framing also preserves feedback. An allocation can change the conditions under which subsequent allocations occur. Infrastructure investment can alter market participation; educational access can change later occupational capacity; concentrated control over a platform can change future access rules; emergency support can preserve an organization that later becomes an important source of employment or dependency. Allocation history therefore becomes part of the architecture conditioning later allocation.

Proposition 12.176 (Allocation as generative intervention). *An allocation can be analyzed as a generative intervention when it changes not only present holdings or access but also the relations, capacities, constraints, dependencies, rules, or transition possibilities that condition later economic histories. The strength and direction of such effects remain empirical and mechanism-dependent.*

12.28.3 Administrative Recipients and Relational Consequences

Administrative systems usually require identifiable recipients. Persons, households, firms, public agencies, schools, hospitals, communities, and other legal or accounting units make allocation operationally possible because they provide addresses for entitlement, payment, reporting, liability, and audit. GRE retains the practical importance of these units while distinguishing administrative tractability from complete representation of economic consequence.

An allocation to one administrative recipient can affect several relational positions. A transfer to a household can alter care arrangements, bargaining, debt repayment,

labor participation, or dependence on external support. Funding to an organization can change supplier relations, employment, infrastructure, knowledge production, or bargaining positions. A subsidy to an intermediary can change access for downstream users whose names do not appear as recipients. Conversely, resources formally assigned to a collective entity can remain inaccessible to some members because of internal authority, membership, or control structures.

The distinction also applies to burdens. Taxes, compliance costs, delays, exclusion rules, or withdrawal of support can be formally attached to one unit while consequences propagate through employees, dependents, suppliers, creditors, communities, or infrastructures. Effective incidence therefore requires tracing economically relevant pathways rather than equating administrative assignment with final consequence.

Caution 12.177 (Administrative convenience and analytical boundary). Administrative recipients provide necessary operational boundaries in many allocation systems. Their usefulness does not establish that the economically relevant consequence is exhausted by the recipient unit. Wider tracing is warranted only where identifiable relational pathways make those effects material to the inquiry.

12.28.4 Relation-Indexed Allocation

Some allocations are better understood by indexing the analytical object to a relation rather than to an isolated recipient. The allocated object can support formation, continuation, transformation, or safe dissolution of a relation; it can also modify the conditions under which participants enter, remain in, or exit that relation. Examples include resources for translation between groups, shared communication infrastructure, mediation, interoperability, care arrangements, collaborative research, supplier development, or maintenance of a jointly used facility.

Relation-indexed allocation does not require treating the relation as a person-like recipient. The relevant administrative vehicle can remain an organization, contract, fund, public agency, or individual account. The analytical index instead identifies the relation whose conditions are being changed. This distinction can be useful where distributing identical amounts to separate participants would fail to create the complementary conditions needed for the relation itself to function.

The concept also requires restraint. Relations are heterogeneous and can be enabling, burdensome, coercive, fragile, or contested. Supporting relational continuity is therefore not a general normative objective. In some contexts, allocation may appropriately facilitate exit, substitution, or dissolution rather than preservation. The analytical task is to identify what relation is affected, how allocation changes its conditions, and what consequences follow for differently situated participants.

Definition 12.178 (Relation-indexed allocation). *Relation-indexed allocation* is an allocation analysis in which the principal object of interest is a specified economic relation and the conditions affecting its formation, continuation, transformation, or dissolution, while administrative receipt may remain assigned to one or more conventional entities.

12.28.5 Higher-Order Allocation

Allocation can also operate on configurations whose relevant properties arise from several relations jointly. Shared infrastructure, commons governance, collective insurance, interoperable standards, multilateral research arrangements, public information systems, and cross-organizational coordination are examples in which the economically consequential object can be higher-order. Allocating only to isolated members can fail to generate the joint condition if complementarity, shared rules, or collective maintenance are essential.

Higher-order allocation should be distinguished from simple aggregation. A large sum distributed among many recipients remains entity-level allocation unless the distribution changes a configuration whose joint structure contributes explanatory content. The analytical justification follows the higher-order criterion developed in Section 12.7: the collective or relational arrangement should add something that cannot be adequately recovered from separate pairwise or recipient-level descriptions.

Governance becomes especially important in higher-order allocation because a shared resource or collective capacity raises questions of membership, access, contribution, maintenance, representation, dispute resolution, and internal distribution. A collective recipient can possess substantial resources while leaving some participants with limited practical access. Higher-order analysis therefore retains internal heterogeneity rather than using collective receipt as evidence of equal benefit.

Remark 12.179 (Higher-order allocation and internal distribution). Where an allocation supports a collective or higher-order configuration, analysis should distinguish the existence of the shared capacity from the distribution of access, control, contribution burdens, risks, and benefits within that configuration.

12.28.6 Multiscale Allocation

Allocation effects can arise at several scales simultaneously. A local investment can alter household access, organizational capability, regional connectivity, or wider supply relations. A national rule can be implemented through heterogeneous local institutions. A transnational standard can restructure firm-level compliance and individual participation. Scale therefore concerns both the level at which allocation is formally decided and the levels at which its consequences become economically significant.

Cross-scale reasoning requires mechanisms. Aggregate expenditure does not by itself establish local incidence, and local benefits do not automatically aggregate into system-wide improvement. Transmission can occur through prices, infrastructure, organizational chains, migration, standards, regulation, finance, information, learning, or other pathways. The relevant scale can also change through time as local arrangements diffuse, become standardized, or interact with higher-level institutions.

Multiscale allocation can generate tensions among objectives that are meaningful at different levels. Concentrating infrastructure can improve system-level throughput while reducing local redundancy; decentralized provision can increase local responsiveness while weakening interoperability; nationally uniform eligibility can simplify administration while interacting unevenly with local costs or capacities. GRE

does not resolve such tensions by privileging one scale in advance. It asks which scales are relevant, how they interact, and which subjects bear the consequences of cross-scale choices.

Proposition 12.180 (Scale-relative allocation consequence). *The consequence of an allocation can vary across analytical scales. Claims that connect recipient-level allocation to organizational, institutional, regional, national, or transnational outcomes require explicit transmission, aggregation, mediation, or feedback mechanisms.*

12.28.7 Allocation under Asymmetry

Allocation takes place within configurations that commonly contain asymmetries in resources, capabilities, information, knowledge, access, institutional position, dependence, waiting capacity, and control. These asymmetries can affect both the process of allocation and the consequences of receiving the same nominal allocation. Subjects with different conversion conditions can obtain different practical capacities from identical transfers; actors with stronger institutional positions can influence eligibility, timing, documentation, or interpretation; dependency can change the practical freedom to refuse conditional resources.

Asymmetry can also be produced by allocation. Concentrating infrastructure, data access, technical capacity, ownership, or decision rights can increase later differences in bargaining position or rule-setting capacity. Conversely, some allocations can reduce a particular asymmetry while leaving others unchanged or creating new ones. Allocation under asymmetry is therefore dynamic and dimension-specific.

The presence of asymmetry does not determine a unique allocation principle. Equal shares, need-sensitive allocation, capability-oriented support, compensation, priority to vulnerable positions, or protection of collective infrastructure can each become relevant under different normative and empirical conditions. GRE's architectural analysis identifies the asymmetries and conversion mechanisms that matter; the justification of an allocation rule requires additional normative argument and institutional specification.

Remark 12.181 (Asymmetry and allocation criteria). Describing an allocation as responsive to asymmetry does not establish which asymmetry should matter, how much weight it should receive, or which allocation rule is justified. Those questions depend on situated goals, values, rights, responsibilities, and empirical consequences.

12.28.8 Relational Allocation Framework

The preceding analysis suggests a relational allocation framework in which allocation is represented through several coupled questions: what is allocated; who or what formally receives it; which conversion conditions determine effective use; which relations and higher-order configurations are affected; how consequences propagate across scales and time; which asymmetries shape incidence; and which later capacities, constraints, dependencies, or options are generated. These questions constitute an open analytical repertoire rather than a fixed sequence of required steps.

A relational allocation analysis can therefore remain simple when the problem

is simple. If the relevant object is divisible, conversion conditions are stable, relational spillovers are negligible, and recipient-level consequences adequately capture the decision, a conventional allocation model may be sufficient. Additional relational analysis becomes useful when access, complementarity, institutional mediation, dependency, higher-order structure, performativity, path dependence, or cross-scale propagation materially changes the consequences of allocation.

The framework also preserves methodological plurality. Formal optimization can clarify trade-offs under explicit assumptions; causal and statistical methods can estimate selected effects; historical analysis can identify path dependence and institutional formation; interpretive and participatory methods can disclose meanings, tacit constraints, and differentiated experience; simulation can explore alternative relational histories. Their appropriate composition depends on the allocation problem and should remain revisable as the architecture changes or new evidence becomes available.

Proposition 12.182 (Relational sufficiency condition for allocation analysis). *A recipient-centered allocation representation can be analytically sufficient when omitted relational, higher-order, multiscale, and historical dimensions do not materially alter the conclusion for the stated purpose. Where those omitted dimensions change effective access, capacity, incidence, dependence, or later transition possibilities, the allocation representation should be expanded accordingly.*

Remark 12.183 (Open status of the allocation framework). The framework developed here is preliminary and non-exhaustive. New economic forms, technologies, institutions, and empirical settings may require additional allocation objects, relational dimensions, or methodological representations. Its role is to make those possibilities analytically visible without prescribing one universal allocation procedure.

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